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LAKE SUPERIOR IRON REGION.

ITS DEVELOPMENT COINCIDENT WITH THE HISTORY OF THE CLEVELAND IRON MINING CO., AND GREAT INTEREST IS THEREFORE ATTACHED TO THE CELEBRATION OF THAT COMPANY'S SEMI-CENTENNIAL.

From 1850 until 1900 is the semi-centennial of the organization of the Cleveland Iron Mining Co.; from 1850 until 1900 is likewise the period of the world's revolution in iron making. The Cleveland Iron Mining Co. is linked to its very marrow with the discovery which swung the world's center of iron and steel production west of the Alleghenies. Will the story of the vast deposits of iron ore in the Lake Superior region ever be written as it should be written? It is a frontier story as picturesque as any that Cooper ever wrote; it is a romance of hidden wealth that throws in shadow the vaulting fancy of Dumas. There is nothing in literature so fascinating as the great commercial novel of the upper Michigan peninsula.

Men are born for all things—Shakespeare to crystallize a language, Cervantes to laugh knighthood out of flower, Napoleon to strip the trappings from a false aristocracy, Washington to establish a democracy and Lincoln to maintain it; and assuredly the men who developed the Lake Superior region were born for the occasion. At the time of the discovery of iron ore in that part of Michigan which the state had accepted under protest the region was further away from civilized habitation than the Klondike. It was a vague, undefined country which could only be reached after infinite labor. Navigation between Lake Superior and Lake Huron was impossible. A mile of racing waters separated the lakes. All freight had to be portaged over the falls—an undertaking both tedious and expensive and an inevitable profit destroyer. The country was uninhabited save by a few Indians and an occasional trapper. All and about was forest, dense and trackless. A government surveyor, William Burt by name, inventor of the solar compass, was laying out a township line throughout this country when the extraordinary variations of the magnetic needle attracted his attention. At no time did the needle point twice in the same direction—at one place it actually went due east. He at once sought about for the cause of the disturbance and found it in indications of rich deposits of iron ore. His discovery was made fourteen miles inland from the shore of Lake Superior. He must have been unconscious of the enormous character of the deposits, since he made no effort to profit by his discovery, but, at any rate, to him belongs the honor of the discovery. The country became flooded with a number of adventurers, who located claims at random and abandoned them later. Indeed the location of the Jackson mine was secured by a man, Dr. Hamilton of Waterveldt, N. Y., who abandoned it later as worthless. Many of them were after copper and considered iron too cheap a commodity to bother about and the distance too far from civilization to make its development profitable.

Not so with a handful of Clevelanders. Samuel L. Mather, a young lawyer, had but recently come to Cleveland to look after his father's real estate interests. The signs were sufficiently plain to him to lead him to forsake his chosen profession and devote his time to the development of the iron mines of Lake Superior. The attention of John Outhwaite, a young chemist, was likewise attracted. Dr. Morgan L. Hewitt, too, joined forces and at various times they visited the region and played the role of original pre-emptors. Outhwaite planted potatoes upon a huge knob of jasper which he took to be iron ore. Planting potatoes was the customary indication of a desire to live upon the premises. The location of the original Cleveland mine was purchased from its finder—a man named Burnell—and then came the work of financing the company. This was done practically by Mather alone, who, as secretary and treasurer, was the moving spirit of the organization.

The mine was 14 miles from the lake. Only an Indian trail led to it. The winters were long and the summers were short. There were litigants to fight bitterly, for the claim did not go undisputed. Every sort of discouragement had to be met and downed. No attempt was made at first to ship ore to the furnaces of Ohio and Pennsylvania. It was converted into blooms in little forges on the shore of Lake Superior. It cost about $200 per ton to make and to transport the blooms to Pittsburg, where they sold for $70—a financial return which soon closed the bloomaries. When the first few barrels of ore were shipped down the lakes the Pittsburg iron makers pronounced it worthless. Owing to its very richness they had failed to convert it into iron. The world indeed had hitherto been unused to ore of so high a grade. It was of higher grade than the famed ores of Sweden.

The Cleveland Iron Mining Co. did not know that then. The disappointments were sufficient to upset most men, but they had faith in their product and faith in themselves. They persevered. They put more money into the business. A plank road was constructed from the mine to the shore of the lake, where a small dock had been erected. In 1855 the canal at the Sault was completed and the first shipment of ore was made to Lake Erie ports. It consisted of about 100 tons of ore and was from the Cleveland mine. Indeed, the Cleveland mine was the only one which shipped ore through the canal at all that year. During the season 1,449 tons were shipped. The ore was tested in various furnaces and found to be of unusual purity. The future of the Lake Superior region was assured, though it was some years later before the Cleveland Iron Mining Co. declared its first dividend. The company developed rapidly thereafter, acquiring additional land, opening new mines, founding a town and gradually building for itself a fleet of vessels.

On Saturday of this week the Cleveland Cliffs Iron Co. celebrates the fiftieth anniversary of the organization of the Cleveland Iron Mining Co. at Ishpeming, Mich. The incorporators in 1850 were Samuel L. Mather, M. L. Hewitt, C. D. Brayton, John Outhwaite, John W. Allen and Isaac L. Hewitt. The directors in 1900 are: William G. Mather, J. H. Wade, E. R. Perkins, Samuel Mather, J. H. McBride, Samuel E. Williamson, W. S. Tyler, J. H. Hoyt and Peter White.

As stated, the company in 1855 shipped 1,449 tons of ore. In 1899 it shipped 1,052,097 tons. Every year the company has shown growth. There has been no retrogression ever. It is one of the greatest enterprises on the continent.

To show how absolute has been the dominion of the Lake Superior region in the world's production of pig iron it is only necessary to quote the statistics of the United States, of the south, and of England and Germany for 1855 and 1899. It was, as shown, in 1855, that the first shipment of iron ore was made from Lake Superior.

	United States.	The South.	Great Britain.	Germany.
1855	784,178	107,669	3,218,154	369,000
1899	13,620,703	2,015,773	9,305,319	8,117,594

The semi-centennial of the Cleveland Iron Mining Co. will be celebrated upon the site of the company's original mine, which will be indicated by a flag. The exercises will be opened with prayer by the Rt. Rev. G. Mott Williams, D. D., bishop of Marquette. The historical address will be delivered by the Hon. Peter White of Marquette, Mich., who has been identified with the history of that region since 1849. During the afternoon a reception to the employes will be given.

INTERNATIONAL CONGRESS OF MERCHANT MARINE.

The international congress of the merchant marine will be held during the week of August 4-12 at the Paris exposition. The business of the congress is divided into five sections. The program may be summarized as follows:

The first section is general and statistical, and has six divisions First, the changes that have taken place during the last thirty years in the merchant fleets of different countries, in their steam and sailing ships, in tonnage, in speeds and in lines of travel; second, state interference in merchant navies, especially with regard to technical maritime education, recruiting and discipline, sailing contracts, efficiency of captains and other officers, mobilization and surveillance of merchant ships; third, statistics of development during thirty years, and changes that have taken place in the same time in salaries, wages and cost of materials; fourth, the relation and competition between sea-borne freight and similar freight carried on railways, canals and rivers; fifth, points connected with various systems for protecting and encouraging the merchant marine, this subhead including questions as to premiums for speed, subsidies and subventions; sixth, the relation between the merchant service and the navy, the obligations of merchant crews, the utilization of passenger and freight ships in time of war, as dispatch boats and transports, and the conditions under which such ships should be reserved by government.

The second section relates to fiscal matters and has four divisions as follows: First, what influence do existing systems of dues and taxes exert on the merchant marine?; second, what is the organization of free ports and zones, and the influence of these ports on the merchant service?; third, statistics on the fluctuation of freights during a certain number of years and the principal causes of such fluctuations; fourth, various methods of measurement.

The third section is technical and has three divisions: First, what modifications can be introduced into existing international rules to prevent collisions, with special reference to signals, alterations in speed, safety apparatus, ocean routes, etc.?; second, international agreement on the load-line question; third, international work to be undertaken to increase safety at sea, such as investigation of ocean currents, destruction of floating wrecks, the path of icebergs, meteorological stations, marine and pilot charts, wireless telegraphy, lighting coasts and dangerous localities, systematization of help at sea.

The fourth section has five subdivisions; it refers to matters connected with the working of the merchant marine. The first subhead deals with improvements that might be introduced in ships, their hulls, engines, boilers, fuel, etc.; second is the nature of crews employed and their wages, especially with reference to negro and lascar crews; third, rules, monopolies and tariffs in the merchant marine; fourth, the reforms that could be introduced with reference to pilotage and salvage; and fifth the neutralization of submarine cables, their improvement and extension.

The fifth section deals with the moral aspect of the merchant service and has three divisions as follows: First, what measures can be adopted to improve the material and moral conditions of the merchant sailor?; second, the best method of organizing provident associations, savings banks, insurances, etc., and the advisability of state interference and the results of existing private philanthropic enterprise; third, the best arrangements for shore and floating hospitals, and generally, the hygiene of the merchant marine.

It will thus be seen that the congress is most important and most comprehensive in its purpose. Mr. Eugene Tyler Chamberlain, United States commissioner of navigation, has been designated by the French authorities as member of the honorary committee headed by Casimir Perier, ex-president of the French republic, under whose auspices the congress will be held.

A despatch from Kingston announces that Calvin & Co., wreckers and general forwarders of Garden Island, Ont., succeeded in releasing uninjured the steamer Spartan from her perilous position in the middle of Lachine rapids, where the water flows at a terrific speed. This is certainly considered the greatest feat in wrecking ever accomplished on the St. Lawrence river.

The business of La Salle & Co., Duluth, will hereafter be operated under the name of G. A. Tomlinson, who was Capt. La Salle's business partner.

FINAL TRIAL TRIP OF THE KENTUCKY.

The recent test of the battleship Kentucky off Newport showed that this magnificent armor-clad was structurally perfect, and that her superposed turrets were worked quite as well as those of her sister ship, the Kearsarge. In the report of the board of inspection and survey, which conducted the final trial, the statement is made that all the projectiles fired in salvo from the aft superposed turret "fell in the same line and appeared to fall in the same spot."

The trial was to test the Kentucky in every particular to determine whether she was built in accordance with plans and specifications, and to decide whether any repairs should be made by the contractors. As required by the contract the Kentucky was kept at sea for forty-eight hours. The machinery, both main and auxiliary, worked well, and the average speed for a two-hours' trial run was 13.95 knots an hour. The indicated horse power of the main and auxiliary machinery was 7,818. Coal was consumed at the rate of 14,300 pounds an hour, or 1.83 pounds per indicated horse power.

Owing to defective polarization the firing of the guns in the forward turret was not satisfactory. Lieut. Bernadou, who had charge of this turret, says in a memorandum submitted with the board's report, that the turret had been fitted electrically for firing the guns individually, and a temporary apparatus connected with the Newport torpedo station was used to fire them in salvo. Owing to the defect mentioned, the right 13-inch gun and the right 8-inch gun of this turret were discharged prematurely at different times. In a further test one of the 8-inch guns was fired without intention. "This shows," says Lieut. Bernadou, "that the battery should be carefully insulated from the ship. It also shows that, with the present arrangement, a ground in any gun may fire another gun."

In the after turret the salvo was fired successfully, the 13-inch guns at 10,000 yards and the 8-inch guns at extreme elevation. It is of this salvo that the board testifies that the projectiles fell in line and apparently in the same place. No casualties occurred in the firing, although some bolts on the guns were broken. The board says that during the turret tests the blasts from the 8-inch, or upper turret guns, did not inconvenience the officers and men at the 13-inch, or lower turret guns. These data were obtained: Forward turret—Recoil of turret structure from right 13-inch gun, 3/8 inch; resultant rotation of turret, 8¾ inches to left; recoil from left 13-inch gun, 4,000 yards elevation, 5-16 inch; resultant rotation, 9 inches to right; recoil from left 8-inch gun, 4,000 yards elevation, 1-16 inch; rotation for same, 1-16 inch to right. After turret—Recoil of turret structure due to salvo guns at 4,000 yards elevation, 9-32 inch; rotation not given.

Several small guns failed to work properly. The automatic six-millimetre Colt guns in the tops failed to work properly. Cartridges jammed and caused long delays. The board has the same criticism to make of the navy department's action in giving a vessel its final trial too soon after completion, as it made in the case of the Kearsarge. It says:

"The board again desires specially to bring to the department's attention the fact that the benefits intended to be obtained by the government as a result of the final trial of the vessel were not forthcoming, the vessel being to all intents and purposes fresh from the hands of the builders. Instead of the department having the benefit of five months' test of the vessel in all its appurtenances and fittings under service conditions, with the consequent opportunity to develop defects and remedies for same, the trial board was inspecting a new and untried vessel under conditions of hull, machinery, etc., which more properly pertained to a first acceptance trial than those which should be requested for the final acceptance trial."

Recommendation is made that the first trial of a vessel shall not take place until it has been practically completed in all particulars. Generally the board reports that there was no weakness and no defective workmanship, except in some insignificant cases, and that the machinery was in good condition, there being no breaking down or signs of deterioration.

THE BERMUDA PONTOON DRY DOCK.

It was recently noted in the Review that Messrs. C. S. Swan & Hunter, Ltd., Wallsend-on-Tyne, had received an order from the British admiralty for a new pontoon dock at Bermuda. The dock will be built on the Clark & Standfield self-docking principle and will be one of the largest yet built. It exceeds in size both the Havana and the Stettin docks, the former of which was built in the year 1879, and the latter in the year 1898 by the same firm, C. S. Swan & Hunter. The extreme dimensions of these three docks are as follows:

	Length.	Breadth.
Havana	450 feet	109 feet
Stettin	510 feet	111 feet
Bermuda	545 feet	126 feet

The clear width at the entrance of the Bermuda dock will be 99 feet and the dock will be capable of admitting a vessel drawing as much as 33 feet of water, the depth of water provided for the dock itself being 52 feet. The total height of the walls of the dock from the bottom of the pontoons is 55 feet and its total lifting capacity 16,500 tons, as against 10,000 tons in the case of the Havana dock. It has been designed so as to be able to lift the longest cruiser afloat, of which the displacement is about 15,000 tons, or the heaviest battleship of 16,500 tons. The pumping machinery will be of the most approved character and will be, as in the case of the Stettin dock, steam driven.

EIGHT LARGEST VESSELS OF THE GREAT LAKES.

	Length, over all.	Beam, moulded.	Depth, moulded.
Jno. W. Gates	498	52	30
Jas. J. Hill	498	52	30
Isaac L. Elwood	498	52	30
William Edenborn	498	52	30
Gen. O. M. Poe	490	50	29
Douglas Houghton	480	50	29
Samuel F. B. Morse	476	50	29
*Harvard	474	50	28½

*Four other vessels building for Carnegie interests (Lafayette, Rensselaer, Cornell and Princeton) are duplicates of the Harvard.

SHIP BUILDING PROSPECTS IN THE PHILIPPINES.

A correspondent of the Iron Age in the Philippines writes a very entertaining letter of the market for ships there. It appears that since American dominion in the islands began the coasting trade has largely increased—so much so in fact that a shipmaster no sooner drops anchor than he is besieged with applications for his craft at any price. The crude craft, already in existence, are inadequate to meet the demands upon them. Any ship that is at all suitable to the navigation of the Philippine waters can be sold forty times over as soon as it gets there. The scarcity of ships has, of course, had the result of making the shipping rates excessive. A number of stores have been opened in the islands by discharged American soldiers and all of them complain of inability to get goods. This is particularly true of machinery or heavy consignments. As wharfage facilities are few, a great part of the cargoes have to be transferred by lighters. This makes a constant demand for vessels of shallow draught to navigate the rivers. It is suggested that steamboats of the old Mississippi river kind would be quite suitable. It is not to be supposed, however, that light craft are the only kind desirable. There is also a demand for substantial craft to visit the general ports. Lumber is plentiful in the islands and it is predicted that a general ship building industry would prove quite profitable. The correspondent says finally:

"Ship yards of the caliber of those in Maine would make a great deal of money here at present, and probably for many years, for now that the coasting trade has been begun there is no estimating as to when it will cease. The chances are that it will be greatly enlarged upon during the next three months. In the meantime the request for boats and ships continues, and tradesmen and shipping masters wonder what they will do for means to carry out the conditions brought by Americanizing the cities and towns of these islands. The question is to be met by putting in ship yards. The necessary equipment for boat building will have to be sent here from America, but the native carpentry can be drawn upon for workmen. Experienced ship builders should be provided to instruct these natives and to oversee their work. The cost for daily wages of the native ship builder is about 20 cents, American money, and he provides for himself and furnishes his own tool. But the native tools are unsuitable for use in an American ship works, and the owner of the plant should calculate upon fitting out the plant with new tools from America or other country than Spain. The present tools in the hands of native ship builders and others are principally from Spain, and for some reason everything Spanish is quite inferior. Such Spanish tools as the writer has noticed here are not suitable for hard service. The steel in them is not good, nor is the finish of the tool perfect. The boring devices are of crude patterns, and most of the mechanism appears to be shaky and tied up with wires and strings.

"The prices offered here for any forms of shipping craft are enough to make an American boat builder wish that he were here with a few hundred small vessels to put on the market. I have seen boats of old design and about ready for the junk pile sold for ten times their first cost. The desire for craft of any description is so great that no one seems to take the trouble to specify the kind wanted. They all want some kind to move goods, and that is about all that is said. But there is no doubt that a lot of steamboats, of moderate size, would meet with ready purchasers. There is as good chance for shipping by steamer as by sailing craft. Small river steamers are the kind most adapted to the service here, and with native crews, captained and engineered by Americans, considerable freighting and passenger business could be done. There are now several such craft running about the different ports with freight, mails and passengers, and all are doing well. They reject a great amount of freight and stock every trip, owing to lack of space aboard."

WHITE AND HICHBORN.

The relief of Sir William White as head of the construction department of the British navy and the appointment of Mr. Watts to that position, with the salary of $15,000 a year and allowances, calls attention to the compensation which this government gives its corresponding officer. Rear-Admiral Hichborn and Sir William White had a good deal in common. Each started life as a shipwright's apprentice—White in the Devonport dock yards, Hichborn in the Boston navy yard. Each worked his way up step by step. They are about the same age, closely resemble each other in personal appearance and manner of speech, both being direct, forceful, plain-spoken men. While the British official received about $20,000, the chief constructor of our navy is paid but $6,000. Rear-Admiral Hichborn has devolving upon him the same responsibilities and tasks which are attached to the work of the British chief constructor. At present he is directly responsible to the government for the design and construction of seventy ships of war, embracing all types, from battleships to torpedo boats. Rear-Admiral Hichborn and Sir William White have maintained a close personal friendship for many years.—Baltimore Sun.

SPANISH CRUISER ESTRAMADURA.

The Spanish cruiser Estramadura, recently launched at Cadiz, is the vessel built out of subscriptions made by the Spanish colonists in Mexico. Her displacement is 2,030 tons, length 290 feet, beam 36 feet and draught 14 feet. Her armor deck is composed of two layers of plates each an inch thick. She carries four Hontoria 5.6-inch quick-firing guns, four Krupp 4.2-inch quick-firing guns, four 2.2-inch guns and two machine guns, but no torpedo tubes. Her two engines are vertical and triple expansion, with eight Thornycroft boilers, developing 7,000 horse power and giving her a speed of 20 knots. It is stated that the cruisers Alfonso XII., Alfonso XIII., Conde de Venadito, Isabel II., Marques de la Ensenada, Temerario, Martin Alonso Pinzon, Vincente Yanez Pinzon, Marquez de Molins and General Valdez, and the torpedo boats Eulalia, Pilar, Condor, Aguila, Seguira, Cuervo, Tarifa, Retamosa, Rigel, Ejerato and Castor, as well as five old coast defense ships, will be sold out of the service, or be devoted to harbor service.

A new tugboat, built for Philip Weaver & Son of Baltimore, has been launched by Joseph W. Brooke & Son at Madison, Dorchester county. The boat will be taken to Baltimore to receive her machinery at the E. J. Codd Co.'s works.

DEARTH OF FRESH ORDERS FOR SHIPS.

IMMENSE OUTPUT FROM CLYDE YARDS, BUT FEW NEW KEELS ARE GOING DOWN ON VACANT BERTHS.

Although reporting a very large output of new vessels lately from ship yards of England and the Clyde, English shipping journals take a very gloomy view of the outlook for orders to fill up the vacant berths. Referring to conditions now prevailing on the Clyde, Engineering of London says:

"The Clyde ship building output for May was a record figure, no output, indeed, for any corresponding period in the history of the industry at all approaching it. The aggregate was 60,000 tons. Unfortunately this activity is not matched in anything like a commensurate degree by fresh bookings, or by promptitude in laying new keels on the berths vacated. As far as reported only some 10,000 tons of new work was booked during the month—a sixth part of the tonnage sent off the stocks—and as bookings have been correspondingly scarce for three or four months past, it will be understood that vacant berths and bare poles have begun to assert themselves in this head center of ship building. The reasons for this are, of course, complex, and not altogether on the surface, but in the main they are easy of explanation.

"Before, however, saying anything in this direction, a few outstanding features as to the May output may be of interest. Both in respect of naval and mercantile work the month's activity in launching presents features of note. The Fairfield works consigned to their 'native element' the first-class cruiser Aboukir, of 12,000 tons displacement, and the torpedo boat destroyer Tiger, of 340 tons. The same day which saw the Aboukir launched, also witnessed the send-off of the merchant steamer Rowanmore, of 9,200 tons gross, from the stocks of Charles Connell & Co., Whiteinch, and of the Ontarian, of 4,500 tons gross, from the yard of Robert Duncan & Co. of Port Glasgow. Other large merchantmen launched during the course of the month were the Itolo, of 5,300 tons, by Denny & Bros., Dumbarton; the Ajax, 6,800 tons, by Scott & Co., Greenock; the Vermont, 4,270 tons, by Barclay, Curle & Co., Whiteinch; the Tucapel, 4,000 tons, by Reid & Co., Whiteinch; and the Hostilius, of 3,500 tons, by A. McMillan & Co., Dumbarton.

"A specially noteworthy item in the 'make-up' of the record May output was the sailing craft Altor, launched by R. Duncan & Co., Port Glasgow. This vessel is for San Francisco owners, and is the largest steel four-masted barkentine ever built in this country for the lumber trade of the Pacific coast. She is 255 feet over all, 44 feet beam, and 19½ feet depth molded, her carrying capacity being equal to about 1,700,000 lineal feet of boards. The four immense steel pole-masts will be a particularly striking feature of the craft, and on the foremast yards will be fitted of such a length as to at once impress us with the tremendous spread of canvas to be carried; the lower yard, for example, being of steel, and about 100 feet long. Other items of note were the paddle steamer Balmoral, launched by McKnight & Co., Ayr, for a South of England company, the engineers—and contractors—for which 'flyer' are Hutson & Sons, Kelvinhaugh Engine Works, who are supplying engines and boilers, which they have undertaken shall send the vessel along at least at 20-mile speed; also the palatial steam yacht Margurite, of 2,000 tons, sent off the stocks by Scott & Co., Greenock, to the order and design of G. L. Watson, the famous Glasgow draughtsman, who in this, as in other important contracts now being fulfilled on the Clyde, has been commissioned by American millionaires. Of course Clydeside industry has been prolific as usual in the matter of launching trawlers, launches, sailing yachts, etc., all of which help to swell the aggregate tonnage, but tell in the reverse way in reducing the average tonnage of the individual vessels produced.

"The five months' total output is, with the exception of that for the corresponding period of last year, the largest on record, but, as has been indicated, big aggregate output is scarcely the thing to be jubilant over in face of the dearth of fresh orders to make up for vacancies. The 10,000 tons which fill the measure of the new work booked during May consists chiefly of two steamers of 375 feet for the Anchor line, and one of 220 feet for Langlands & Co. of Liverpool and Glasgow. Other orders may have been secured, but none have been authoritatively announced. The vacant berths and bare poles now plentiful all over the Clyde testify, in fact, to the continued absence of orders, and are only what we might expect after not only one, but three or four months' marked cessation in placing new work.

"Although some reduction has been made in the price of steel plates, which now stand at about £8 5s. per ton, and better delivery can now be guaranteed, much more will be required ere ship owners are found entrusting their commissions to the builders. Until coal is reduced in price and the carriage of material is less exorbitant, steel makers—especially in the face of arrears of contracts still to work off—will not be in a position to make such reductions as will enable the ship builder effectively to tempt the hesitating ship owners. Unfortunately, the high wages prevailing in coal industries, the eight-hours' day agitation, and the continued great demand, are considerations inducing coalmasters to keep up prices, and while this continues there seems little prospect of events taking the turn desired."

In accordance with a provision of the naval appropriation act Secretary Long has appointed a board of naval officers to proceed to Charleston and Port Royal, S. C., to determine by personal inspection whether it is advisable to build a dry dock at Charleston or to retain and repair the existing dry dock at Port Royal. Should the board decide in favor of Charleston it will select a site for the dock near that city. The board will consist of Rear Admirals Rogers, Sumner and Barker, Capt. Converse, Civil Engineer Asserson, Constructor Linnard and Lieutenant-Commander Staunton.

D. McPherson, manager of the Yarmouth Steamship Co., whose boats run between Yarmouth and Boston, says the negotiations between his company and the Dominion Atlantic Railway for the purchase by the latter of his company's steamers and franchises are off. The price of $350,000 was agreed upon, but the terms of payment were not satisfactory. A bill before the Dominion parliament to give effect to the proposed purchase will be withdrawn.

JAPAN'S SHIP YARD AT NAGASAKI.

The decision of the Japanese to build all their own mail steamers from this time on invites more than passing attention to their big modern ship yard at Nagasaki. From its almost ideal situation Nagasaki has been known as the queen of Japanese harbors ever since the beginning of Japanese commerce, and the growth of its ship building industry has added and will add immensely to the importance of the place. Until well into the present century the smiling bay had sheltered no more seaworthy craft than the old-time junks, whose bulky, unpainted hulls and awkward, square sails, floating lazily by, are still familiar along the Japanese coasts. Within more recent years the bay's expansive waters have been crowded with swiftly moving steamers. But down to the last half decade all these were foreign built; even the noble battleship Kasagi, the other "men-of-war" which achieved such signal triumphs in Chinese waters during the Chinese-Japanese war, and the numerous minor vessels used in the war were imported from abroad for the use of the mikado and his subjects. Within the past two years, however, Nagasaki's ancient haven has become the birthplace of no less than seven typical modern ocean-going steamers of the most recent patterns; splendid vessels whose merits have been recognized wherever the ships have become known and which are Japanese from stem to stern.

The Hitachi Maru was the first born. She is a steel steamship launched nearly two years ago—April 16, 1898—and is now in government employ for carrying the mail. Her lines are of extreme beauty and her speed is 14½ knots an hour, although this can be increased by forced draft. She has three decks and measures 462 feet in length by 49 in breadth and 33½ in depth. She has a tonnage of 6,360 tons, twin screws, triple expansion engines and four boilers.

The Awamaru is another handsome steel vessel, 452 feet long. She makes 12 knots an hour and is fitted out with all conveniences for passengers. She was launched July 27, 1899, since when she has won her spurs as a swift, beautiful and perfectly appointed ship. A third Nagasaki-built liner has just started on her maiden voyage to Great Britain at the rate of 14½ knots an hour. She is a twin-screw and a two-master.

The interesting yard at which these and four other modern steamships have been constructed is the property of the celebrated Mitsubishi company, at whose head is Baron Iwasaki, Japan's Croesus, a multi-millionaire, worth the equivalent of more than $70,000,000. The company takes its name from his family crest, three scarlet stones, which appear on the pennants waving above many great warehouses of Yokohama, Tokyo, Nagasaki and other commercial cities of the land of the rising sun. The baron, a Samarai by inheritance, received his title to a nobility upon the conclusion of the Chinese-Japanese war as a token of appreciation of his many generous gifts for the successful prosecution of that conflict. In his progressive disposition he is characteristically Japanese and for the management of his ship building interests has secured the services of a man widely experienced in the construction of modern sea craft the world over, Mr. P. J. McCormick. Interviewed recently, Mr. McCormick said that it was not easy when inspecting the surroundings to realize that he was engaged in anything so distinctively commercial as ship building, but that within the yard nothing was wanting in the way of modern equipments to lead one to suppose he was outside the heart of an American city.

"The yard is so arranged," he went on to say, "as to construct three steamers of 500 feet, 350 feet and 250 feet length respectively. There are facilities also for the building of several smaller steamers simultaneously. In connection with the yard and on the same premises are all kinds of the most recent appliances for shearing, bending, rolling, punching and hydraulic riveting, together with every kind of woodworking machinery. The engine works has a depth of water alongside the pier of 25 feet, and steel shear legs capable of handling 100 tons lifts, with steam hoisting and lowering power, are attached to the pier. The smiths' shop is supplied with steam hammers up to seven tons. The foundry is 172 feet long and 50 feet broad, with two wings of 25 feet each, making a total breadth of 100 feet. It is supplied with two hydraulic overhead traveling cranes of thirty and fifteen tons, with a height of 24 feet clear below traveling crane girders. The king roof columns are 20 feet high and the erecting shop has a thirty-ton hydraulic crane, besides one of fifteen tons.

"In the workshops are all kinds of the most modern and improved machinery, while the boiler-making department has such numerous and complete appointments as to make it possible for the largest steel boilers to be constructed. The riveting and handling of these are done entirely by hydraulic power. Diving gear, with experienced foreign and native divers, are attached, also pumps with complete apparatus for salvage operations. Nothing ever devised for a successful yard is missing in the outfit of this establishment."

Mr. McCormick referred to the gift which Queen Victoria made long ago to the Japanese before ever their rapid vision had enabled them to comprehend the superiority of western ships over their own. She presented them with a little gunboat which she endeavored to make particularly attractive to their Oriental eyes by decorative painting and gilding. After a long passage the boat arrived at Yokohama, and the first thing these curious Japanese did was to scrape it bare from keel to deck to make it a worthy companion to their unpainted junks. Another nautical anecdote which Mr. McCormick called to mind was in connection with the Japanese eagerness to manage their first imported steamship. "They are as thoughtless as they are bold and enterprising," said he, "amiable, but simple as children. A splendid ship named the Laimon came from a foreign firm and they insisted upon navigating it immediately. So the European sailors and engineers were at once turned out and the little Orientals were masters of the vessel, which they started at full speed. So far so good, but when they wanted to stop it was impossible. They did not know how. They put the helm about and began to turn around constantly in a circle, meanwhile calling for help. Finally one of the French men-of-war in the roadstead, taking pity on them, sent some one to stop the engines."

Nagasaki's lovely harbor was the first in Japan to be entered by a foreign vessel, that of the Dutch in the sixteenth century, and within Nagasaki's boundaries was erected the first Christian Japanese church, a Jesuit chapel.

DREDGING ON THE MISSISSIPPI.

EXPERIENCE WITH HYDRAULIC DREDGES IN REMOVING SAND BARS—METHODS ADOPTED AND RESULTS OBTAINED—CAPACITY OF DREDGES, COSTS, ETC.

By F. B. Maltby, Member Engineers' Club of St. Louis.*

The subject of the hydraulic dredges built for the Mississippi river commission has received pretty thorough discussion since the inception of the project by Col. Henry Flad some eight or nine years ago. The writer does not purpose giving a historical discussion of various schemes for dredging the river, or a description of the dredges themselves, as that part of the subject has been thoroughly exhausted in the paper presented before the American Society of Civil Engineers recently by J. A. Ockerson. The writer has thought that the relation of some experiences in the operation, the methods and the results obtained might prove of interest, and possibly of some value.

During the temporary absence from July, 1898, to May, 1899, of Mr. C. W. Sturtevant, who was commissioned as captain in the third regiment of volunteer engineers, the writer was in charge of dredging operations under the Mississippi river commission as "superintendent of dredging." During the season of 1898 the dredging plant consisted of six dredges, the Alpha, Beta, Gamma, Delta, Epsilon and Zeta. The Beta was, however, undergoing extensive alterations, and was not in commission during the season. Each dredge while in commission was accompanied by a towboat, a pile driver, a plunder barge and a coal barge. In addition, there were connected with dredging operations three survey parties, each quartered on a steamboat, and an inspection boat. The entire fleet in operation during the season consisted of five dredges, nine steamboats, five pile drivers and the necessary barges and fuel boats.

The organization was as follows: The dredging operations are carried on under the direction of the secretary of the Mississippi river commission, who is also the disbursing officer and has an office in St. Louis. The fleet was in direct charge of a superintendent of dredging, who determined on the localities to be dredged and the disposition of the various dredges, ordinarily located the cuts to be made at each point and in general had the responsible charge and supervision of the operation of the fleet. The routine office and clerical work, which in itself is no small matter in connection with operations of this magnitude, passed through his hands. A suitable boat was furnished for his use, and he was constantly passing over the river, sounding all crossings, keeping himself fully informed as to the condition of the channel and directing the operation of the dredges.

The river below Cairo (and the operations of the dredges under discussion are confined to that portion of the river) is divided into three districts. The first two have a length of about 100 miles, and the third extends from the lower limits of the second down stream as far as dredging was necessary. In 1898 this limit was Wilson's Point, La., 531 miles below Cairo. To each of these districts was assigned a survey party, whose duty it was at the beginning of the season to make surveys of all crossings likely to become troublesome. These surveys are repeated at those points where trouble develops. On the maps of the results of these surveys was laid out the location of the channel proposed to be dredged. Surveys are made during dredging operations and at various times after the work is completed. The surveys are accurately made, but with experienced men they are made very rapidly. They are of the utmost importance, as without them no intelligent knowledge of conditions governing the location of cuts or of results obtained, except in a most general way, could be had. It frequently happened that at points where shoal crossings had been reported by pilots these surveys showed the existence of better channels than those in use by steamboats, and that dredging was unnecessary. Each party consisted of the engineer in charge, two recorders and the necessary boat crew.

Each dredge was in charge of a master, and carried a mate, carpenter, machinist, blacksmith, recorder, clerk and steward, two engineers and a double crew. The total number, amounting to about fifty men, were quartered and subsisted on the dredge itself. The duties of all are indicated sufficiently by their names, except possibly the recorder. He was usually a young man of some engineering education or training, and upon him devolved the duty of keeping the records of operation and the making of reports. He located, by means of sextant angles, the position of the dredge at the beginning and end of each cut, and they were plotted on the maps furnished by the survey parties. The dredges were operated twenty-four hours per day, the division of time to each crew being the same as that usual on river steamboats. Records are kept of soundings taken at every 25 feet advance, ahead of the dredge, on each side and at the stern. Daily reports are made showing the number, length and average depth of cuts made, average rate of advance per hour, average steam pressure and average speed of pumps; also a distribution of time into placing plant, dredging, changing cuts, repairs, making up tow and towing and "waiting orders" if not in actual operation dredging. The towboats accompanying each dredge carry only a single crew. In 1898 five steamboats of a size large enough to handle a dredge were chartered at a cost of from $40 to $60 per day for boat and equipment only, not including crew, fuel or supplies. During 1899 the government completed five steel-hulled towboats built for this purpose. They are 171 feet 6 inches long, 36 feet beam, and four of them have cylinders of 22 inches diameter by 8 feet stroke; the other one 24 inches by 8 feet stroke.

Coal, which is one of the large items to be provided, was purchased in 1898 under a contract which provided that the contractor should deliver it in barge lots in his own barges, and at the dredges wherever they might be between Cairo and Helena. This arrangement proved to be a satisfactory one in practice, and no trouble was experienced in keeping a supply on hand. A barge holds from 12,000 to 15,000 bushels, and is held alongside the dredge and the coal used out of it as needed, practically no coal being stored on the dredge. Other supplies were purchased wherever they could be had to the best advantage, and were delivered on board the dredges by steamboats plying on the river and landing against them without hesitancy.

After having determined on the location of a proposed channel, and having brought the dredge and plant to the vicinity, the head mooring piles are set at the upper edge of the bar if it is not over 1,000 to 1,200 feet across (the length of the hauling cables) and about 1,000 feet from the lower edge if it is wider than this. These mooring piles are simply iron tubes about 11 inches outside diameter; metal ½ inch to ⅝ inch in thickness. They are 35 feet long and are made in two sections with a flange connection. A shackle is fastened to them at such distance from their lower end as it is desired that the piles penetrate the bottom, usually 15 feet. The upper end is closed and provided with a ring for handling. Near the upper end is a hole drilled and tapped for 2½-inch pipe and connected by a length of ordinary fire hose with a pressure pump. The pile drivers, or more properly pile sinkers, are provided with the ordinary leads, but no hammer, a hoisting engine, pressure pump and necessary boiler. The piles are rapidly sunk by forcing water through their interior, escaping at the lower edge, and by their own weight. In sand it is very quickly done. I have seen a pile sunk 15 feet into sand in 2½ minutes from the time it was swung into the leads. The water pressure carried on the pumps is from 40 to 70 pounds per square inch. Before sinking, a bridle line (simply a piece of cable 30 feet long with an eye in each end) is fastened to the shackle and the free end kept above water In the meantime the discharge pipe line has been connected up. The latter is in 50-foot sections, the sections being connected with rubber sleeves about 3½ feet long. The operation of slipping the sleeves over the ends of the discharge pipe is a tedious and disagreeable proceeding, owing to the fact that the discharge pipes are submerged for about one-third to one-half of their diameter. Those who have struggled with forcing a pipe of slightly larger diameter into a piece of ordinary hose can possibly imagine the ease with which a 32 or 34-inch hose is forced over the end of a pipe half submerged in ice cold water.

The piles being in position, the dredge is brought up as near them as possible and anchored by means of the spud. The hauling lines are then attached to the bridles. In attaching the cables to the piles it is found that the dredge is more easily manipulated if the cables cross; that is if the cable from the starboard hauling engine is led to the port pile and vice versa. The spud is then raised, the dredge dropped back with the current to the lower edge of the bar, the suction-head lowered and the main and jet pump started. The suction head is ordinarily allowed to sink to the full depth, 15 to 17 feet, before pulling ahead; the dredge is then pulled ahead by the cables, the rate of advance depending on the material encountered and the depth of the cut. This rate varies from 60 to 150 feet per hour and is sometimes higher. When the dredge has again reached the piles it is dropped back; a second cut is made alongside the first one, and the operation is repeated till the desired width has been obtained. When the axis of the dredged channel is at an angle with the current, or when a strong wind is blowing, side piles may be set, to which lines are attached for holding the dredge in position. This sounds very simple, and the operation is a simple matter under favorable conditions and in clean material. In 1898 the Delta was stationed at island No. 34, and the material encountered was sand, gravel, lignite, shale, stumps, logs and the wreck of a coal barge containing coal. A channel was opened successfully through this material, but only after a long series of exasperating breakdowns; while, on the other hand, at a crossing where there was clean material, this dredge opened a channel 9 feet deep and 250 feet wide in one day. The Gamma in dredging a channel at island No. 40 removed fifty-four logs, varying from 8 to 50 inches in diameter at the butt and having an aggregate length of over 1,500 feet. In consequence of this severe usage, accidents of a more or less serious character are not unusual. Each dredge is supplied with a machine shop, equipped with an engine lathe of 18 to 24-inch swing, a drill press, a shaper, a bolt and pipe machine and an emery wheel, all driven by a small independent engine; also a forge, with the necessary tools and a full assortment of small tools, hoists, etc.

At the beginning of the low-water season the troublesome bars develop rapidly, and in order to keep open a channel of the requisite depth it is necessary that the dredges be operated continuously at their full capacity; and they are not permitted to stop on account of any trifling disarrangement to machinery. At one time the piston in the low pressure cylinder of the jet pump engine on the Gamma was broken, and at about the same time the air pump, operated in connection with the condenser to the main pump engine, was disabled. Dredging, however, was continued without a jet and without a condenser, a small amount of live steam being admitted to the low-pressure cylinder to equalize the work on the engine. The rate of advance of the dredge did not seem to be materially affected. The material being handled was, however, a clean loose sand, readily moved, and the relation of this incident is not to be understood as indicating a belief that either the jet or the condenser may be dispensed with.

While the dredges were yet in the field it was thought desirable to determine their capacity under working conditions as nearly as these could be had. Each of the dredges, before acceptance from the builders, had been tested by measuring the discharge deflected for a brief interval of time, usually less than a minute, into a measuring barge. It was feared that test conditions might not be the same as working conditions, and that the determination of the short-time interval required in filling the barge might be a source of error. In making these field tests a location was sought where clean sand of nearly the size of channel sand could be found, and where there was no current, so that no material would be moved except by the dredge. The site was carefully cross-sectioned, and after the test was completed it was again cross-sectioned and the total amount moved was thus determined. The Gamma was tested at Cow island bar. Eight cuts were made, aggregating 4,566 feet. On this there was 45 hours and 30 minutes actual dredging. The material encountered was chiefly a rather fine sand with a very small quantity of blue mud. The total amount of material moved was 45,856 cubic yards, or 1,008 yards per hour. The average depth of cut was 7.16 feet, and the average advance per hour was 100.3 feet; average steam pressure, 145.6 pounds; average speed of main pump, 150 revolutions per minute. The vacuum on suction pipe of the main pump was 8.6 feet of water, and the discharge head 11 feet, or in other words the pump was operating against 19.6 feet of water. Seven hundred and fifty feet of discharge pipe was used. The original test shows an average capacity of 1,523 yards per hour.

The Delta was tested at island No. 18. The material was all sand, possibly averaging a little finer than channel sand. Four cuts were made, aggregating 2,711 feet in length, and occupying 27 hours and 23 minutes actual dredging. Material to the extent of 34,462 yards was moved, or 1,259 yards per hour. In making the last cut the dredge was pushed to its highest possible capacity without sinking the discharge pipe. Distributing

*From the Journal of the Association of Engineering Societies.

to this cut that proportion of the total volume moved to which it is entitled from a consideration of the rate of advance and depth of cut, we have 2,550 yards per hour for the capacity limit of this dredge. In the material encountered during the test the capacity of the dredge, however, seemed to be limited only by the ability of the pontoons to carry the discharge pipes when loaded with the sand handled by the pumps. The average advance per hour was 99 feet, average depth of cut 6.55 feet, average steam pressure 151.1 pounds and average speed of pump 140.9 revolutions per minute. The suction head was 16.3 feet, and the discharge 34.5 feet of water, or a total of 50.5 feet of water against which the pump operated. The original test gives a capacity of 1,829 yards per hour with a 67.6-foot head. One thousand feet of discharge pipe was used in each case.

The Epsilon was tested at Phillips's bar in medium sand, with a small amount of mud. Four cuts were made, aggregating 2,015 feet, and occupying 24 hours and 50 minutes, during which time 32,407 yards were moved at the rate of 1,305 yards per hour. The average advance per hour was 81 feet against a cut of 9.6 feet; average steam pressure, 130 pounds; average speed of pumps, 178 revolutions. The combined suction and delivery head was 44.4 feet of water. One thousand feet of discharge pipe was used. The original capacity tests give an average of 2,553 yards per hour with a total head of 58.5 feet. In comparing these tests with the original tests allowance for loss of efficiency, due to wear in the pumps, must be made, and in the case of the Gamma this loss was evidently a large one, as will be shown later on.

A test was also made with the Zeta at Cherokee bar, to determine the feasibility of cutting a channel through a dry bar, and also to determine the capacity. So far as demonstrating the first-mentioned proposition, the test was an entire success. Into a dry bar a hole was cut approximately 500 feet long, 140 feet wide on top and having a depth of from 3½ to 4 feet above water and 13 feet below water along the axis of the cut. The sides of the cut below water stood at a very considerable angle with the vertical. It would have been entirely practicable to have cut a channel entirely across the bar to deep water on the opposite side, a distance of 1,200 feet, had it been desirable to do so. The capacity test was, however, unsatisfactory, owing to the material encountered, and cannot be regarded as showing the capacity of the dredge while at work on submerged bars of channel sand. The composition of the bar above water and to a depth of 7 feet below was pure sand, but below this, and probably extending to the depth reached by the suction pipes, was blue mud. Had the suction pipes been raised above this mud the amount of material moved would undoubtedly have been much larger. The total volume moved was 40,991 cubic yards, or only 652 yards per hour. As this dredge is identical in size and construction with the Epsilon the difference in amount of 1,305 and 652 yards per hour probably represents the difference in capacity when handling the two different materials, sand and mud.

It is manifestly impossible to give any approximate cost of moving the material per cubic yard, as it is impracticable to ascertain with any degree of accuracy the amount of material moved. The surveys of the ordinary crossing, made before and after dredging, give results as a whole, but do not indicate the amount of material moved by the dredge alone. The river may, for instance, have been almost on the point of breaking through a bar, so that a start made by a dredge would encourage the current to complete the channel. In such a case the amount of material moved by the dredge would be only a small part of the total amount moved in opening a channel. On the other hand, a cut may be so located that it is constantly being filled by the current, and in this case the amount moved by the dredge is greater than appears. A computation was made of the cost per yard handled during the tests. This cost includes fuel, payroll, subsistence, lubricating and lighting supplies, and any small repairs made during the time occupied in testing. It does not include any allowance for cost of plant, towing to point where test was made or cost of steam tender. The average cost for the three dredges first mentioned was 85-100 of a cent per cubic yard. The total cost of operating five dredges during the low-water season of 1898, comprising a total time for one dredge of 403 days, and extending from Sept. 3 to Dec. 23 was $92,052.89, and including surveys, general superintendence and inspection, $120,272.76, or an average of $225.93 per day per dredge for the operating expenses alone, or nearly $300 per day including all expenses connected with dredging operations.

As a matter of curiosity, the writer has determined the total amount of material moved during the season, assuming that the dredges during the time of actual dredging were handling 90 per cent. as much sand per hour as was handled during the capacity tests. The total is something over 2,500,000 yards, or at a cost of a little less than 4 cents per yard for operating expenses for the season. These figures, it is understood, are based on mere assumptions, and have no value except to give a very general impression of the magnitude and cost of the operations.

The year 1898 was not one of extreme low water, as the lowest reading was 7.7 on the Cairo gauge. This does not, however, necessarily indicate that there was proportionally more water in the channel than during extreme low-water years, for the season was one of constant fluctuations; and this condition, as is well known, tends to produce less water over the crossings than does a slowly falling or stationary river, even though the stage reached may be considerable lower. At not time during the season, as far as I know, was there less than 8½ to 9 feet in the channel below Cairo, which is more than for several years previous. How much of this was due to the dredges can only be surmised, but I think no one will deny that they are entitled to some of it, for at no time did a dredge, attacking a bar, fail to open a channel with 12 to 13 feet of water; and this channel, if properly located, was maintained without further work as long as the river continued to fall or remained stationary, though it was very likely to be partly obliterated by a rising river.

The proper location of the dredged channel is the most important feature in connection with the success of dredging operations. If properly located the river will assist in making the cut, and, in fact, in many instances, as noted, the action of the current scours out more material than is actually handled by the dredge, a start having been made by the latter. On the contrary, if the channel be improperly located it is impossible to keep it open. No rule can be laid down for these locations, as they depend on the conditions at each bar, and success is acquired only through experience and a careful study of the movement of the channel under various circumstances.

Babcock Loving Cup.

PRESENTED TO MR. W. I. BABCOCK BY THE OFFICERS AND EMPLOYES OF THE CHICAGO SHIP BUILDING CO. ON HIS RETIREMENT FROM THE PRESIDENCY, JULY 1, 1900.

HARBOR WORK AT TOLEDO AND SANDUSKY.

Toledo, O., July 11.—In a talk regarding government work at this point and Sandusky, Mr. Wm. T. Blunt, United States assistant engineer, gives out some information that will prove of value to vesselmen. The United States dredge, since its return from some emergency work at Sandusky, has been working on the 21-foot channel at Toledo, above the Lake Shore company's railroad bridge. This channel from the Lake Shore bridge to the Schenck coal wharves will be dredged as soon as possible to the full depth of 21 feet, but possibly not more than 100 feet wide, which seems to be all that is necessary at present.

The casing around the draw pier of the Pennsylvania railroad bridge, which has for many years projected outside of pile protection and under water, has been inclosed by a new pile protection on each side of the draw. This was done at the request of the chief of engineers of the United States army, after the accident which happened last fall, when a barge was seriously damaged by striking this casing.

The contract of Lydon & Drews Co. for deepening and widening of the straight channel, is well under way, three dredges being now at work near the inner end of the channel. The present channel will first be deepened to 21 feet throughout, after which the widening will be entered upon. The final result will be a channel 21 feet deep and 400 feet wide. The light-house department has already issued a notice to the effect that while this dredging is in progress the spar buoys may be occasionally displaced in the vicinity of the work. It has been found necessary to change these buoys back and forth along the channel, or even some times to remove them entirely for a short time. This may cause some inconvenience to boats and all should use especial care in navigating the channel in the vicinity of the dredges. So far as possible the dredges will be kept some distance from each other, but occasionally they may be so close together as to necessitate extra care on the part of vessel captains.

Under the contract of E. J. Pryor, the new outer range at Sandusky has been opened up for 100 feet on each side, from its intersection with the Cedar point range inward to the "Deep Hole." At the lake end, however, the Cedar point range should still be closely followed until this new range is reached. Several boats this season have attempted to reach the lake upon this outer range and have been delayed some time by grounding. This range cannot be safely followed between the lake and buoy No. 4 by boats drawing over 12 feet. Dredging is now in progress on the extension of the dock channel from the main city front up to the wharves of the "Short Line" railway. Early in July this channel will have been opened up for a width of 80 feet by recent dredging. Along the city front the channel depth is about 16½ feet at mean level with a soft bottom. It is expected that during this summer this channel will be deepened for a width of at least 60 feet.

Fire broke out in the angle building of the Cramp works, Philadelphia, on Sunday. By quick work the firemen succeeded in confining the fire to that building. The United States battleship Alabama and the Russian cruiser Variag were lying near, but were not damaged.

The torpedo boat destroyer Dale will be launched from the works of the W. R. Trigg Co., Richmond Va., July 24.

A FAMOUS OLD SCHOONER.

From the Boston Evening Transcript.

The oldest schooner afloat in American waters and one of the oldest in the world in point of active commission is the Polly of Calais, Me., Capt. McFarland, owner and master, built in Amesbury, Mass., in 1805 and recently started on her ninety-sixth year of voyaging along the Maine coast. There is probably no other schooner in any waters with as interesting a history as the 65-ton Polly, which was a privateer in the war of 1812, was captured and escaped from the British, sailed to the Golden Gate in '49 and around the world several times, and who in her prime was regarded as one of the fastest schooners on the seas. Even now after nearly a century's buffeting of the seas of many lands, the staunch little coaster can show her heels to many of the more modern craft she meets from Calais to Boston, where she is well known by old mariners. In her sturdy old age she sails as a worthy testimonial of the art of the ancient ship builders of Massachusetts. "She's as able a craft today," recently remarked Capt. McFarland admiringly, as he was putting the finishing paint touches on her, "as she was the day of her launching, nearly one hundred years ago."

Over four score years ago the Polly's deck bristled with guns as she scoured the seas preying upon British commerce under command of Capt. Jeduthun Upton of Salem, Mass., until she was captured by his majesty's ship Phoebe of forty-four guns. Although captain and crew were taken to England and held as prisoners of war for seven months, the brave Polly escaped that ignominy, her English prize crew joining the fortunes of Uncle Sam. Half a century ago she was sailing around the Horn with an adventurous party of Forty-niners from Maine. Since that time the Polly has sailed nearly all the navigable waters of the globe and has always made her home port right side up. The Polly has not missed a visit to Bar Harbor every year in August since the North Atlantic squadron has visited there, and has been warmly received by the admirals in command of the fleet, who look for her as they do for the smiles of the pretty belles of Bar Harbor.

Capt. Jeduthun Upton, who owned and commanded the Polly in 1812, when he fitted her out as a privateer, was one of the most noted seafaring men of Salem and one of the most patriotic citizens of the town. He was born in Salem, Sept. 6, 1785, and died in Havana July 26, 1821. He married on May 12, 1807, Sally Smith, whose father, Jerrie Smith, was one of Washington's body guard and a noted patriot. Capt. Upton's sister Sally married Dr. Hemenway of Boston and was the mother of the late Augustus Hemenway, who at his death was one of Boston's wealthiest citizens. Capt. Upton and a crew of twenty sailed on the Polly on her first privateering cruise from Salem, Mass., Dec. 7, 1812, was captured by the British frigate Phoebe on Dec. 23 after she had taken several prizes, and Capt. Upton did not set his foot on American soil again until the July following. Of his sufferings and trials, his indignation at the harsh treatment by the British prison ship officials, the impressment of American sailors into British trading vessels, the collusion of the American transport commissioner with the British, and other interesting sidelights on the war of 1812, from a privateersman's point of view, Capt. Upton kept record in the Polly's log. The log, though yellow with age, is clearly decipherable, and is in possession of Mrs. S. H. Lincoln of Machias, Me., a granddaughter of Capt. Upton. From its pages the following interesting story of the Polly's participation in the war of 1812 is for the first time published:

The Polly sailed on her first and what was fated to be her last privateering cruise, according to Capt. Upton's log, from Salem, Mass., Dec. 7, 1812, on a bright Sunday afternoon at 4 o'clock, and under fresh southwesterly breezes was soon making 7 and 8 knots an hour. At 4 o'clock the following day a schooner was discovered to the northward steering straight for the Polly; she displayed a signal, which was answered by the Polly, which hove to and put after her. The chase was kept up till 7 in the evening, when, being within gunshot, one of the Polly's 9-pounders was brought forward and her first hostile shot was fired. The English schooner, which Capt. Upton made out as the privateer Liverpool, veered off a few points and the Polly put after her, but the schooner, much to the sorrow of the Polly's crew, became shut up in the fog. The entry of Dec. 13 recounts that cold weather, illy-clothed crew and fog prevented his exercising his crew, one of whom, Daniel Sanborn, was put in irons for "broaching a barrel of pork."

On Dec. 15 the lookout on the masthead discovered at 2 p. m. a fleet of eight sail steering to the south'ard. For six hours the fleet-footed Polly gave chase and lost them in a fog, but at 11 o'clock that night a blue light was observed, and all hands were beat to quarters. They made her out to be a brig, which was hailed, and ordered to stand for the westward. The seven accompanying sail at that moment flashed into view like passing spectres and disappeared as quickly in a thick veil of fog. The stranger hove to, and Capt. Upton sent a boat and crew to her who soon returned with the captain and the brig papers. She was from St. John, N. B., loaded with fish and bound for the West Indies under convoy of the Nimrod, with twenty guns. A prize master was put on board, and she was headed for Boston, the gallant Polly losing no time in resuming the chase for her sister vessels. Before the captured prize left four Americans and a German of her crew joined the fortunes of the Salem privateer. The seven sail were never seen afterward by the Polly.

On Dec. 20 the Polly captured her second prize—an English transport, No. 245, loaded with provisions. According to the log, Capt. Upton resorted to clever sea tactics in the capture. The transport was chased from 7 to 12 a. m., when, being within gunshot, the decks were cleared for action and the Polly ran up the English ensign and pennant. The transport altered her course and the Polly, when within musket shot, lowered the English colors and ran up the Stars and Stripes, accompanying it with a solid shot across her bow. The transport immediately struck colors and a crew from the Polly being sent on board, sailed her for the nearest American port. For two days following not a sail hove in sight, and there was much rejoicing on board the Polly over her two prizes. The rejoicing was short-lived, however, for it was destined to be a sad Christmas for the Polly, Capt. Upton and her crew, whose fate it was not to see their native land again for many long, weary months. The log of Dec. 23 thus tells the story:

"At 7 a. m., discovered a sail. From her maneuvering, we judged her to be a merchant ship. We immediately hauled our wind for the purpose of getting to windward of her and succeeded; but the wind died and with it our hopes. At 2 p. m. the breeze sprang up and we put after her, although she was five times our size. Within two gunshots she fired at us. We immediately hauled our wind from her to see if she would follow. She did, and soon began to come fast upon us. As she drew nearer I saw guns bristling from her decks. Thirty or more shots were fired at us. I saw that the battle would be unequal and firing our 9-pounder at her ordered the guns heaved overboard, as it would be madness to hold out longer. We hove to and they sent boats to us and took us all on board. She proved to be the English frigate Phoebe, Capt. Hilyar, who treated us more like friends than enemies. Thus ended this most unfortunate day in latitude 43° 30′, longitude 36° 20′. On board his majesty's ship Phoebe, 44 guns, 270 men, day before Christmas. Capt. Hilyar of the Phoebe returned to Capt. Upton his sword, quadrant and glass. Polly's crew disheartened, but are treated with unlooked-for consideration."

SEVENTY SHIPS OF WAR.

THAT NUMBER AUTHORIZED AND UNDER CONSTRUCTION FOR THE UNITED STATES NAVY—THE LIST INCLUDES TWELVE BATTLESHIPS, FIFTEEN CRUISERS AND FOUR MONITORS.

A report just at hand from Rear Admiral Hichborn, chief of the bureau of construction and repair, navy department, shows a total of seventy vessels authorized and under construction for the United States navy on the first of the present month. The list includes twelve battleships, six armored cruisers, nine protected cruisers, four monitors, one gunboat, sixteen torpedo boat destroyers, fifteen torpedo boats and seven submarine torpedo boats. Names of the vessels, their speed and names of builders will be found in the following tables:

BATTLESHIPS.

Name of Vessel.	Speed, Knots.	Builders.
Kentucky	17	Newport News Co., Newport News, Va.
Illinois	17	Newport News Co., Newport News, Va.
Alabama	17	Cramp & Sons, Philadelphia, Pa.
Wisconsin	17	Union Iron Works, San Francisco, Cal.
Maine	18	Cramp & Sons, Philadelphia, Pa.
Missouri	18	Newport News Co., Newport News, Va.
Ohio	18	Union Iron Works, San Francisco, Cal.
Pennsylvania	19	Designs in preparation.
New Jersey	19	Designs in preparation.
Georgia	19	Designs in preparation.
Virginia	19	Designs in preparation.
Rhode Island	19	Designs in preparation.

ARMORED CRUISERS.

West Virginia	22	Designs in preparation.
Nebraska	22	Designs in preparation.
California	22	Designs in preparation.
Maryland	22	Designs in preparation.
Colorado	22	Designs in preparation.
South Dakota	22	Designs in preparation.

PROTECTED CRUISERS.

Denver	17	Neafie & Levy, Philadelphia, Pa.
Des Moines	17	Fore River Engine Co., Weymouth, Mass.
Chattanooga	17	Lewis Nixon, Elizabethport, N. J.
Galveston	17	Wm. R. Trigg Co., Richmond, Va.
Tacoma	17	Union Iron Works, San Francisco, Cal.
Cleveland	17	Bath Iron Works, Bath, Me.
St. Louis	22	Designs in preparation.
Milwaukee	22	Designs in preparation.
Charleston	22	Designs in preparation.

MONITORS.

Arkansas	12	Newport News Co., Newport News, Va.
Connecticut	12	Bath Iron Works, Bath, Me.
Florida	12	Lewis Nixon, Elizabethport, N. J.
Wyoming	12	Union Iron Works, San Francisco, Cal.

TORPEDO-BOAT DESTROYERS.

Bainbridge	29	Neafie & Levy, Philadelphia, Pa.
Barry	29	Neafie & Levy, Philadelphia, Pa.
Chauncey	29	Neafie & Levy, Philadelphia, Pa.
Dale	28	Wm. R. Trigg Co., Richmond, Va.
Decatur	28	Wm. R. Trigg Co., Richmond, Va.
Hopkins	29	Harlan & Hollingsworth, Wilmington, Del.
Hull	29	Harlan & Hollingsworth, Wilmington, Del.
Lawrence	30	Fore River Engine Co., Weymouth, Mass.
Macdonough	30	Fore River Engine Co., Weymouth, Mass.
Paul Jones	29	Union Iron Works, San Francisco, Cal.
Perry	29	Union Iron Works, San Francisco, Cal.
Preble	29	Union Iron Works, San Francisco, Cal.
Stewart	29	Gas Engine & Power Co., New York, N. Y.
Truxtun	30	Maryland Steel Co., Sparrow's Point, Md.
Whipple	30	Maryland Steel Co., Sparrow's Point, Md.
Worden	30	Maryland Steel Co., Sparrow's Point, Md.

TORPEDO BOATS.

Stringham	30	Harlan & Hollingsworth, Wilmington, Del.
Goldsborough	30	Wolff & Zwicker, Portland, Ore.
Bailey	30	Gas Engine & Power Co., New York, N. Y.
Bagley	28	Bath Iron Works, Bath, Me.
Barney	28	Bath Iron Works, Bath, Me.
Biddle	28	Bath Iron Works, Bath, Me.
Blakely	26	Geo. Lawley & Sons, Philadelphia, Pa.
De Long	26	Geo. Lawley & Sons, Philadelphia, Pa.
Nicholson	26	Lewis Nixon, Elizabethport, N. J.
O'Brien	26	Lewis Nixon, Elizabethport, N. J.
Shubrick	26	Wm. R. Trigg Co., Richmond, Va.
Stockton	26	Wm. R. Trigg Co., Richmond, Va.
Thornton	26	Wm. R. Trigg Co., Richmond, Va.
Tingey	26	Columbian Iron Works, Baltimore, Md.
Wilkes	26.5	Gas Engine & Power Co., New York, N. Y.

SUBMARINE TORPEDO BOATS.

Of the seven submarine torpedo boats only one (the Plunger) at the works of the Wm. R. Trigg Co., Richmond, Va., is under construction. Designs for the other six, authorized by the last congress, are under consideration.

The gunboat, referred to above, is for the great lakes, to replace the Michigan, and was authorized by the act of May 4, 1898. The construction of this vessel has been suspended pending an adjustment of certain regulations between the United States and Great Britain regarding the building of war vessels on the lakes.

The Eastern Ship Building Co. of New London, Conn., intend to sublet the contract for constructing propelling machinery for the two large Hill Pacific cargo and passenger steamships. The vessels will have triple expansion engines, twin-screw and probably water tube boilers of about 10,000 indicated horse power. The speed of these ships is stated as 14 knots and the deadweight capacity over 20,000 tons.

TWO HUNDRED MILLIONS.

COST OF A 21-FOOT AMERICAN WATERWAY FROM THE LAKES TO THE ATLANTIC SEABOARD — FINAL REPORT FROM THE GOVERNMENT COMMISSION — A 30-FOOT CHANNEL WOULD COST $317,284,348—ENGINEERS RECOMMEND A 21-FOOT CHANNEL BY WAY OF LASALLE-LEWISTON ROUTE AROUND NIAGARA FALLS AND OSWEGO — MOHAWK ROUTE FROM LAKE ONTARIO TO THE HUDSON RIVER.

The final report of the deep waterways commission, dealing with routes for a ship canal within United States territory from the great lakes to the Atlantic seaboard, was given to the public by the war department a few days ago. It is a voluminous document of more than 2,000 typewritten pages with its appendices, and contains 141 maps and drawings, designs of structures and profiles. There are twenty-three appendices, many of them technical engineering documents of great scientific value.

The commission recommends a 21-foot channel as the maximum depth of the waterway. Two routes are considered for getting from Lake Erie to Lake Ontario. One is from Tonawanda via Lockport to Olcott at the mouth of Eighteen Mile creek, a distance of 25 miles, and the other is from Lasalle, below Tonawanda, on the Niagara river, to Lewiston on the Niagara river below the falls, a distance of 9 miles. This latter is the recommended route. It presents some sensational engineering difficulties. For 6 miles the whole cut is through solid rock, and the canal ends at Lewiston with an astounding descent by means of eight double locks, of which six have a lift of 40 feet each and two of 39.4 feet each, very nearly 320 feet. Concerning the respective merits of these two routes the report says:

"Referring to the estimate for the Tonawanda-Olcott route, it will be noted that it exceeds the estimated cost of the Lasalle-Lewiston route by $6,060,550 for a 30-foot channel and $2,136,900 for a 21-foot channel. It is found that a steamship of 19 feet draught in the 21-foot channel would consume 1 hour and 9 minutes more time between Buffalo and a point common to the two routes in Lake Ontario in traversing the Tonawanda-Olcott waterway than by the Lasalle-Lewiston route, and that in a 30-foot channel a steamship of 27 feet draught would be 1 hour and 43 minutes longer by the Tonawanda route. Since the cost of maintenance of the Lewiston waterway would be less than for the route from Tonawanda to Olcott, the interest and expense account will be much less for the former, and, as the actual time saved by a steamship on the Lewiston route would be from 11 to 16 per cent. of the time of passage, it is evident that both economy in construction and cost of transportation definitely determine the Lewiston waterway as the preferable route. The natural harbor at the mouth of the Niagara river and the comparatively small amount of restricted channel on the Lewiston line make it a better location on which to construct a waterway than the route from Tonawanda to Olcott."

FROM LAKE ONTARIO TO THE HUDSON.

To get from Lake Ontario to the Hudson river two routes were considered. One was from Oswego on Lake Ontario up the Oswego river to Lake Oneida, through that lake, across the divide at Rome and the Mohawk valley, and down the Mohawk river to Schenectady, then across country to Normans Kill, avoiding the great water power interests at Cohoes and Troy, and reaching the Hudson in the southern suburbs of Albany. The Hudson will require improvement as far south from this point as Germantown, about 25 miles from Albany. The mouth of Normans Kill is just 140.7 miles from the battery at New York. Two modes of construction are reported upon for this route, called respectively the high and low level plans. One proposition is to cross the divide at Rome on a high level, locking up and locking down, establishing a great reservoir by damming the Black river at Carthage and conducting the water for 80 miles or more to feed the canal. The alternative proposition is to cut through the divide on the level of Oneida lake, which will itself be the reservoir in that case for keeping the canal supplied with water. A supplementary reservoir may be constructed by damming the Salmon river, 30 miles away. The low level project is regarded as the preferable one, although costing $1,678,100 more at the outset.

The competing route from Lake Ontario to New York is down the St. Lawrence river to Lake St. Francis, and then across to Lake Champlain, which is entered a few miles above Rouses' point. The lake is followed to Whitehall, at the southern extremity of the Narrows. From there a direct cut is made across to the Hudson at Fort Edward, a little below Glens Falls. The route becomes identical with the other, at the mouth of Normans Kill at Albany. Curiously enough the actual number of miles of standard canal to be constructed by these two routes is almost exactly the same, 102.42 by Oswego and 102.35 by Lake Champlain. There is 96 miles of river to be canalized by the Oswego route, and 134 by Lake Champlain. There are fewer locks by the Champlain route, but two of them must be tremendous affairs, having lifts of 52 and 48 feet respectively. The lockage by the Lake Champlain route is really 292 feet less than by the Oswego low level route, but the total distance is 208 miles longer by Champlain. It is estimated that the type of lake carrier taken for the consideration of these problems, will use 12 hours more time going from Lake Ontario to New York by the Champlain route, although it would have to make eighteen more lockages by the Oswego route.

DISTANCES, ENGINEERING PROBLEMS, ETC.

The total distance from Buffalo to New York by the Lasalle-Lewiston route to Lake Ontario, and by the Oswego route to the Hudson, will be 476.94 miles, and by the Champlain route to the Hudson 685.21 miles. The total distance from Chicago to the Battery of New York via the Lasalle and Oswego routes is 1,367.6 miles, and from Duluth 1,466.5 miles. The Champlain route increases these distances 208 miles. If the Olcott route were used in passing Niagara 12 miles would be added. Concerning the comparative usefulness and value of the several routes, appendix 5 of the report says:

"On the Champlain route the changes, except at Ft. Miller, will be beneficial to water power interests; but on the Oswego and Mohawk a rearrangement of several of the power plants will be necessary. At Oswego and on the Mohawk below Schenectady all interference with power rights has been avoided by locating the routes outside the river valleys. Probably the most serious difficulty on either route will be to make satisfactory arrangements for railroad crossings. This is especially the case in the Mohawk valley, where the river is paralleled by the four tracks of the New York Central and by the two tracks of the West Shore railroads. Ample provisions have been made in the estimates for either swing or bascule bridges for all crossings, but in the case of the New York Central crossing the number of trains is so great that a high grade crossing or a long embankment or an embankment and trestle may be necessary. With a slight readjustment of the railroad lines in the vicinity of Rome, only one such high viaduct will be needed. The cut-off at Normans Kill is estimated to save $20,000,000 by not disturbing power rights at Cohoes and Troy.

"The estimated cost of these routes from Lake Erie to the Atlantic are as follows:

Champlain route	$183,420,600
Oswego-Mohawk route, high level	197,718,200
Oswego-Mohawk route, low level	199,396,300

"Open navigation can be maintained on the Champlain route 230 days, and upon the Mohawk route 245 days, for average year. The round trip from New York to Chicago, including terminal detentions, will take 16 days and 9 hours by the Champlain route, and 15 days and 8 hours by the Oswego route, or for a full navigation season a steamship capable of making 12½ statute miles per hour in the open lake, and 8 miles an hour in the canals, would be able to make fourteen round trips by way of Champlain and sixteen round trips by way of Oswego during the season. A steamship could therefore transport freight from Chicago to New York by the Oswego route for 93 per cent. of the rate necessary to charge by the Champlain route, to make the same annual profit. Assuming that freight can be transported over the improved waterway between New York and Chicago for an average rate of $1 per ton, the saving by the Mohawk route for an annual traffic of 30,000,000 tons would amount to $1,400,000. If the more expensive low level Mohawk waterway should be constructed the first cost would be about $15,975,700 in excess of what it would cost to construct the Champlain route. If 3 per cent. interest be assumed as the rate paid by the government for the money used in constructing the waterway, the saving in the annual fixed charges due to the difference in cost of the waterways would be $479,270, and for the difference in the cost of operation and maintenance $42,740, making a total of $1,132,010 in favor of the Champlain route, or about 80 per cent. of the amount saved on transportation rates by using the Mohawk waterway.

PRESENT CONDITIONS ON THE LAKES FAVOR A 21-FOOT CANAL.

"From a careful consideration of the type of ship best adapted for carrying the lake commerce and of the depth of channels and waterways of the lakes and from the lakes to the Atlantic, required for such ships, it is evident that the proposed 21-foot waterway will furnish better returns for the transportation of domestic and foreign commerce than can be obtained by constructing a waterway 30 feet deep from the lake ports to the seaboard."

The report very insistently clings to the 21-foot channel as the maximum depth for the deep waterway. It is pointed out that the natural depth of lake channels and harbor entrances about the lakes points to this depth. The channels already constructed at the Sault, at Lake St. Clair and in the lower Detroit river conform to this depth. If a 30-foot channel were built nearly 60 miles of excavation in deep water would be necessary to make the connecting channels of the upper lakes conform to the increased depth. The report points out that the interest on the increased expenditure and the fixed charges of maintenance would considerably exceed anything gained in diminished cost of transportation resulting from the building of deeper-draught steamers. The limit seems to be therefore 21 feet, the carrier to have a draught of 19 feet. To build a 30-foot channel for a carrier of 27 feet draught would not pay, comparatively speaking. Then there enters into the consideration the loss inflicted on vessel owners by the deeper channels and larger vessels making smaller craft obsolete long before their time. Many coast harbors of the United States also suggest the same depth of 21 feet, and South American ports also.

The canal proposed will be about 250 feet wide at the bottom, with sides that slope to 300 feet at the surface of the water. The surface width of the canal will be almost exactly that of the present St. Clair Flats canal. In rock excavations the slope of the sides will be much less, making the canal seem narrower. Around curves the surface width will be widened. There will be such construction that a speed of 8 miles an hour will be perfectly feasible in the canal. This is permitted at the St. Clair Flats canal, and vessels frequently exceed it. At no point in the waterway will there be a current greater than 4 feet per second, or under 3 miles per hour. The ordinary current through the canal at the Flats is 1.7 miles per hour. Where rivers are canalized the width of the channel will vary with the amount of water to be taken care of, and will, in the Mohawk, vary from 250 feet to 1,000 feet.

Channels in the lakes and connecting rivers are expected to be 600 feet wide at the bottom as a minimum. At the Sault the report advises the excavation of the channel from Hay lake to Mud lake to the west of Neebish, instead of trying to improve the present Hay lake channel. In the lower Detroit river the only changes recommended are the straightening somewhat of the present channel by rounding off some corners.

The total cost of the proposed deep waterway, with all its proposed regulating works, including the expenditures for damages to existing interest, and other charges of all kinds, is given as follows: For the 21-foot channel from Lake Superior to Lake Erie, $6,691,818; from Lake Erie to Lake Ontario by the Lasalle-Lewiston route, $42,393,203; from Lake Ontario to tide water by the Oswego-Mohawk route, low level plan, $157,003,082; total, $206,358,103. The 30-foot channel by the same route would cost $317,284,348.

The Tropical Fruit & Steamship Co., a new enterprise, purposes to enter the fruit business in competition with the United Fruit Co. It is said that it has recently acquired twelve steamships which will be utilized in carrying the business from Cuba, Jamaica, Central America and other tropical countries to Newport News and New Orleans. The company was formed last month under the laws of Maine, with a capital stock of $500,000. Martin H. K. Paulsen of Baltimore is president.

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It is definitely settled that Col. Jared A. Smith is to be transferred. Indeed there has never been any hope of reconsidering his transfer. He has been at the Cleveland post longer than it is customary for the war department to retain an engineer anywhere. His successor will be Col. Mansfield of San Francisco. It is a little unfortunate that a young man is not assigned to the port of Cleveland at once. Col. Mansfield will retire in two years, and in the nature of things will not take the same interest in continuous engineering work that a younger man would. The Cleveland assignment is one of the most responsible in the chain of lakes. There is great work to be done—work which will be any man's monument when it is done. A young engineer would enter with zest into the work and take great pride in watching its development through a series of years. The harbor of Cleveland is in a formulative period and it needs one mind to direct it. It is to be hoped that when Col. Mansfield's term expires he will be succeeded by a young man of promise and energy.

Concerning the armor plate contracts for 35,250 tons which the navy department is about to let, a director of the Bethlehem Steel Co. said, after the company's recent annual meeting: "The Bethlehem company will bid for the entire contract, and I think I may safely say the rate specified will be lower than any that we have ever offered the government before. The reason for this is easily found in the magnitude of the contract to be awarded. Heretofore the government has seldom made contracts for more than 2,000 tons of steel plate at any one time, and while such a contract will keep our large steel presses busy for a short time, its completion leaves them idle for a much longer period, and while thus idle they are necessarily an expense to the company. If we secure this contract, however, it will mean enough work to keep these presses going for several years, and consequently we will be in a position to undertake the work for a smaller price than could possibly be offered on a contract of say two or three thousand tons."

In the midst of life we are in death. The annals of the lake have yet to record a more pitiful bereavement than that of James Corrigan, vessel owner of Cleveland. None of its tragedies is more shocking, none in which the blow is so individual and so crushing. Surrounded by his family yesterday he is today alone. The pity of it is too that it seems so inexcusable. The accident to the Idler should never have happened. She was a staunch boat, designed to weather a gale. The evidence is conclusive that she would have weathered it readily had she been properly handled. The first principle of sailing is to reef when storm threatens. The captain should have lowered his canvas—all of it. It is idle for him to say that the boat would have been capsized had all her canvas been down. That is a practical impossibility. The dead are Mrs. James Corrigan, Miss Ida Corrigan, Miss Jane Corrigan, Miss Etta Corrigan, Mrs. Charles Riley and Baby Riley.

The wisdom of the creation of the naval strategic board is now apparent. It does not interfere, as it was feared it might, with the work of the bureau of navigation or the bureau of construction and repair. It attends strictly to its business of formulating plans of action in case of hostilities. The present complication in China has given the board the paramount excuse for its being. Whatever movement of ships there may be in the orient will be under its direction. In case of actual conflict it is quite likely that the president of the board, Admiral Dewey, will take active command of the fleet. The board has been in session at Newport during the past two weeks. Of course, the utmost secrecy obtains regarding its doings. That could hardly be otherwise.

It is curious how many journals made the mistake of saying that the new vessel building for the North German Lloyd Co. is to be 752 feet in length, in other words, making her considerable larger than the Oceanic. This new German liner, as the Review noted sometime ago, is to be 706 feet long. But Messrs. Harland & Wolff of Belfast, Ireland, are now building for the White Star line a vessel which will exceed the Oceanic in length by 50 feet. The Oceanic, however, is likely to be the largest vessel constructed during the nineteenth century.

The secretary of the navy has been singularly happy in the selection of names for the six submarine boats. Each name is quite suggestive of the kind of creature the submarine craft is. The names are Grampus, Shark, Pike, Porpoise, Adder and Mocassin. Could any names be more appropriate and more deadly?

CARGO RECORDS OF THE GREAT LAKES.

None of the 500-foot steamers entering the lake trade this season have as yet taken on cargoes equal to those moved last season by the big steel tow barges. Although most of the lake freighters are loading to nearly 18 feet mean draught, the stage of water in connecting channels is not quite equal to that of last year when the 18-foot mark was exceeded. The Rockefeller tow barge John Smeaton still holds the record, with a cargo of 7,446 gross or 8,339 net tons of ore to her credit. This cargo was moved about the middle of last season. The largest cargo credited to any of the new 500-foot steamers this season is one of 7,215 gross or 8,081 net tons of ore, moved from Two Harbors to Conneaut by the John W. Gates, of the American Steamship Co.'s fleet. The Rockefeller steamer E. C. Pope recently carried 6,585 net tons of coal from Erie to Duluth. This is the largest coal cargo ever moved on the lakes. The cargo records follow:

Iron ore—Tow barge John Smeaton, owned by Bessemer Steamship Co. of Cleveland, 7,446 gross or 8,339 net tons, Duluth to Cleveland, draught of 18 feet 1 inch; tow barge Manila, Minnesota Steamship Co. of Cleveland, 7,399 gross or 8,237 net tons, Two Harbors to South Chicago, draught of 18 feet; steamer Malietoa, Minnesota Steamship Co. of Cleveland, 7,335 gross or 8,215 net tons, Two Harbors to South Chicago, draught of 18 feet ½ inch; steamer John W. Gates, A. B. Wolvin of Duluth, manager, 7,215 gross or 8,081 net tons, Two Harbors to Conneaut.

Grain—Steamer Superior City, A. B. Wolvin of Duluth, manager, 266,550 bushels of corn, equal to 7,463 net tons, South Chicago to Owen Sound, draught of 18 feet 2 inches; steamer Superior City, A. B. Wolvin of Duluth, manager, 200,000 bushels of wheat and 41,800 bushels of flax, equal to 7,175 net tons, Duluth to Buffalo, mean draught of 17 feet 3 inches; steamer Andrew Carnegie, Wilson Transit Co. of Cleveland, 332,100 bushels of oats, equal to 5,313 net tons, Manitowoc to Buffalo.

Coal—Steamer E. C. Pope, owned by Bessemer Steamship Co. of Cleveland, 6,585 net tons of bituminous, Erie to Duluth; steamer Hendrick S. Holden, Capt. John Mitchell and others, Cleveland, 6,432 net tons of anthracite, Buffalo to Duluth, on a draught of 17 feet 4½ inches.

FREIGHT SITUATION ON THE GREAT LAKES.

Reports from all branches of the iron and steel industry are still of a very unsatisfactory kind, but as far as actual changes in rates are concerned the lake freight situation is just as it has been since the opening of navigation. Representatives of John D. Rockefeller, controlling practically all the vessels that are not engaged in contracts, are continuing the policy of keeping enough ships in ordinary to limit the "wild" tonnage to a minimum, and thus save a freight market that would long ago have gone down to a basis of 50 cents on ore from the head of Lake Superior if it were not for this influence. Ore shippers say that within the past few days they have secured more "wild" tonnage than at any time since the opening of the season, but aside from this claim there is nothing of interest to be told about the market.

The heavy movement of iron ore, looked for on the opening of the season, continues unabated. As noted a week ago, the shipments to July 1 are more than a million and a half tons in excess of what they were on the same date a year ago. The exact figures are 6,415,840 gross tons to July 1, 1900, against 4,755,956 tons to the same date in 1899, a gain of 1,659,844 tons. June shipments in 1900 aggregated 3,149,952 tons.

DEATH OF CAPT. FRED N. LA SALLE.

Capt. Fred N. La Salle, who died last Friday at his home in Duluth after a severe illness, was one of the most picturesque characters associated with vessel interests on the great lakes. He was known everywhere on the lakes and had a wide circle of friends. Capt. La Salle was born in Bloomingville, O., July 3, 1848, and was a descendant of the famous Breckenridge family of Kentucky. He was left to his own resources at the age of eleven years and found employment as a cabin boy on the lakes. Later he became cook on one of the lake vessels, and when the war broke out he left to become cook for a colonel of an Ohio regiment. At the second battle of Harper's Ferry, in 1862, he was captured and sent to Libby prison, where he remained for several months before it was discovered that he was not a soldier at all. At that time he was only fourteen years old, and upon his release he determined to see the south.

At the close of the war he shipped on an ocean schooner and sailed before the mast. Later he went to Denver to engage in the construction of the Union Pacific railway. In going through the Cheyenne pass he was captured by Indians, but was recaptured by soldiers the next day. He returned east and shipped on a schooner on the lakes and within a month thereafter was wrecked off Goderich, Ont., and for forty-eight hours was lashed to the mast. Upon his rescue he shipped in another boat and was again wrecked, this time barely escaping with his life. He gradually worked his way up until he was commodore of the Lehigh Valley line.

In 1880 he went to Duluth and first engaged in the coal business. Then he entered into partnership with A. B. Wolvin in a vessel and insurance agency. In 1895 he formed a partnership with G. A. Tomlinson which continued at the time of his death. During the past four or five years Capt. La Salle was prominently identified with Geo. L. McCurdy, W. A. Prime and others in conducting marine insurance on a very large scale. About a year ago Capt. La Salle took a trip to Europe for the benefit of his health and returned in a much improved condition. Later he went to California for the same purpose, but his case gradually proved helpless.

After the funeral at Duluth the remains were shipped to Chicago for interment. Following were the pall bearers: Honorary—George L. McCurdy, Charles E. Peck, W. M. Egan, Edward Smith, John Mitchell, R. R. Rhodes, James Davidson, James W. Millen, A. B. Wolvin and Alexander McDougall. Active—James J. Rardon, D. Sullivan, C. H. Sinclair, James Channon, James R. Sinclair and F. B. Higgie.

"Graphite" is a very attractive publication, issued by the Joseph Dixon Crucible Co., Jersey City, N. J., for the purpose of establishing a better understanding in regard to the different forms of graphite and their respective uses. The July number is unusually interesting.

COMMODORE CHARLES H. LORING, U. S. N.

By Walter M. McFarland, in Cassier's Magazine for Jul .*

In every organization there are men who, from the very beginning, seem to give promise of future distinction, and by their professional ability and readiness to accept duty, gain for themselves the requisite training, so that, when the time comes, they are ready to fill the higher positions which offer themselves. Such a man is Commodore Charles H. Loring, who has long been one of the conspicuous figures in the Engineer Corps of the navy. He comes of good old Massachusetts stock, and was born at Boston in 1828. His education was received in the public schools of Boston, which, even at that day, were noted for their excellence, as is attested by the commodore's writings, which would never disclose the absence of a college course. Having selected engineering as his life work, he followed the approved routine of the time, for there were then no technical schools, and served a regular apprenticeship as a machinist. At its close, in 1851, he entered the navy as third assistant engineer, attaining, by competitive examination, the highest place in a class of fourteen.

His entrance into the navy was just too late to give him an opportunity for participation in the Mexican war, and by the time the Civil war broke out he had passed through all the junior grades and had become a chief engineer. During his service in junior grades he had been laying the foundation for his more important work when an older man and in higher positions, a portion of his shore duty having been as assistant to the engineer-in-chief of the navy, Mr. Samuel Archbold, in which capacity he had charge of the experimental work and tests of engineering devices coming before that office. It is interesting to note that while engaged in this duty he made a test of the first injector which came to this country. During the Civil war he was in active service the whole time, and during the first eighteen months was fleet engineer of the North Atlantic station, being attached to the fine old steamer Minnesota. He was on board this ship during the attacks of the Merrimac on the northern fleet in Hampton Roads on the eighth and ninth of March, 1862, when the Cumberland was sunk and the Congress burned, and when the Minnesota also was attacked. A 7-inch rifle shot went through the Commodore's room; but, fortunately for him, he was at his post of duty in the engine room, so that he was not injured.

A little later he was detached from sea duty and sent to Cincinnati to supervise the construction of three river and harbor monitors and also of some light draught sea monitors building there. Subsequently he was made general inspector of all the ironclad steamers building west of the Alleghenies, having in charge at one time eleven monitors building at Pittsburg, Cincinnati and St. Louis. During the Civil war a number of excellent engines had been accumulated for hulls which were in process of construction, but with the close of the war all work was stopped, and after a time a board was appointed to recommend the best disposition of these engines which were stored in the various navy yards. It was about this time that the compound engine was coming into general use, and the same board was directed to make a study of the compound engine with a view to its introduction in naval vessels. Of this board Commodore Loring was senior member, and associated with him was the late Chief Engineer Charles H. Baker. After a very exhaustive study of the subject, they recommended the introduction of compound engines and the abandonment of the simple form, and the conversion of a number of the engines which were on hand into compound engines. Four sets of these simple engines were so converted and were fitted to the Vandalia, Marion, Quinnebaug and Swatara. The tests of these engines were very satisfactory and showed a coal economy for short runs of not much over two pounds of coal per horse-power-hour.

This study of the compound engine made it natural that Commodore Loring should be selected as the representative of the navy department when, in 1874, he and the late Dr. Charles E. Emery made an elaborate series of trials of the engines of the revenue cutters Rush, Dexter, Dallas and Gallatin, to determine by actual test the relative economies of compound and simple engines, designed for the same work in similar hulls, and also to secure reliable and authoritative data with respect to the economy of steam jacketing. These tests were the first of the kind conducted under circumstances of entire reliability, with the result that the report of the trials was re-published all over the world, and is still quoted in all the text-books on steam engineering. The tests on steam jacketing were very valuable, and a study of these led to the suggestion of a reheater between the high and low-pressure cylinders, a practice which is now almost universal in all economical compound engines on shore.

Commodore Loring's next tour of sea duty was as a fleet engineer of the Asiatic station on the U. S. S. Tennessee, where he had as his chief assistant George W. Melville, who later became his successor as chief of the bureau of steam engineering. There was nothing specially eventful in this cruise, and at its end, in 1880, he was assigned as the head of the steam engineering department of the New York navy yard. This was the period of greatest inactivity in the history of the navy, and there was little to do, even for a very active man, except routine work. During this tour, however, Commodore Loring was senior member of a board that made a test of the machinery of the Anthracite, a little yacht with a triple expansion engine working with 600 pounds pressure. The experiments were valuable as showing that, with the form of apparatus on board the Anthracite, there was no such gain in economy as to warrant the tremendous pressure carried, while it involved numerous practical difficulties.

In 1881 Commodore Loring was a member of what is known as the first naval advisory board, appointed by Secretary Hunt to formulate a ship building programme for the navy which he might submit to congress. His engineering associates were Commodore B. F. Isherwood and Chief Engineer Charles H. Manning. The personnel of this advisory board was distinguished in all its branches, and the work they did made possible our splendid fleet of today, as they definitely decided to abandon wooden hulls for those of iron and steel, and for general progress in every respect. In 1882 he was a member of another important board known as the navy yard board, of which Admiral Luce was senior member and Mr. A. B Mullet, the supervising architect of the treasury, a colleague. The duty of this board was to visit all the navy yards of the country for the purpose of determining which of them might with advantage and economy be closed. It was a delicate task, but the report, when finally approved, gave general satisfaction, and its recommendations were carried out.

On the retirement of Engineer-in-Chief Shock, only two successors were thought of, one of whom was Commodore Loring, and his merit and thorough qualification for the position were so well recognized that the appointment came to him entirely unsought. This was in 1884, during the administration of President Arthur. Secretary Chandler was presiding over the navy department at this time, and it was under his supervision that the four vessels commonly known as the Roach cruisers, the Atlanta, Boston, Chicago and Dolphin, were built. Part of the scheme of building the new navy was the organization of what was known as an advisory board composed of two civilians and a number of naval officers. Owing to this regime the bureaus were not given the same free hand that had obtained since the advisory board was discontinued, although they did valuable work in the details of designs. Forced draft was used on these new vessels, after having been tried on two others—the Alliance and Swatara—under Commodore Loring's direction.

In 1885, with the advent of a new administration, there was a general spirit of unrest about the navy department from what seemed to be a prevailing belief that whatever was, was wrong. The air was filled with rumors of intended changes, among them one which promised to cause a violation of the contract labor law, as it was actually seriously under consideration to import a British engineer and put him in charge of the design of machinery. From this intent and other indications it became evident to Commodore Loring that he did not enjoy the secretary's confidence and he tendered his resignation. After leaving the bureau of steam engineering he was made senior member of the experimental board of naval officers at the New York navy yard, which board, under his direction, conducted many exceedingly valuable experiments. Among the most important were the competitive tests of water tube boilers to determine the type that should be used on the coast defence vessel Monterey, and it may be well here to call attention to the fact that this was the first case on record where a boiler had ever been run for twenty-four hours when burning more than fifty pounds of coal per square foot of grate. Another very important series of experiments conducted by Commodore Loring were those on the boilers of the torpedo boat Cushing, to determine the economy of evaporation with different air pressures and rates of combustion. These experiments have proven of the greatest interest, and form a very valuable collection of engineering data. A number of clever devices had to be schemed out to carry on these tests, and the whole success was a great credit to Commodore Loring and the board. Having reached the age limit in December, 1890, he was placed on the retired list; but having always been a man of very vigorous physique, he did not give up active employment, and was for a time consulting engineer to the United States & Brazil Mail Steamship Co. During the late war with Spain he was recalled to active duty and assigned as inspector of engineering work in New York city.

What has been said thus far is simply a sketch of professional work done by Commodore Loring, but it gives little idea of the man himself, and it is his personality which is of most importance to his friends. He is a man of peculiarly lovable disposition, and one who wins the affection of all who are brought in contact with him. As an after-dinner speaker he is always a success, but probably he is at his very best with a party of congenial friends, when his remarkable skill as a raconteur has an opportunity for full play. His personal popularity is shown by the fact that for two years he was president of the Engineers' Club in New York city, and for one year president of the American Society of Mechanical Engineers. He is first vice-president of the Army and Navy Club of New York and also one of the vice-presidents of the Society of Naval Architects and Marine Engineers. He is still hale and hearty, and does not look his age by ten years.

*Up to a few years ago Mr. McFarland was one of the capable and loyal young assistants of Engineer-in-Chief Melville of the navy. He is now with the Westinghouse companies.

Another large Atlantic freighter, the Consuelo, will soon begin running into New York. This steamer, built for Thos. Wilson, Sons & Co. of Hull, England, by C. S. Swan & Hunter of Wallsend-on-Tyne, has just finished a builders' trial. She is intended to carry a large general cargo, besides a number of cattle. Her leading dimensions are 475 feet by 52 feet by 34 feet to upper deck; above the upper deck a complete shelter-deck has been fitted for carrying the cattle, above which again there is a complete bridge, in which the accommodation for crew, engineers and officers has been provided, besides staterooms for a limited number of passengers. The machinery was provided by Thomas Richardson & Sons of Hartlepool, and consists of two sets of triple expansion engines, each having cylinders 22, 37 and 64 inches by 42 inches stroke, steam being supplied by four single-ended boilers 15 feet 6 inches diameter by 11 feet 7 inches long, working at 200 pounds pressure, and fitted with Ellis & Eaves induced draft. The trial proved in every way satisfactory, and a mean speed of 13 knots was attained on several runs over the measured mile.

It has been decided by the Philadelphia & Baltimore Steamboat Co., known as the Ericsson line, to establish a regular service between Philadelphia, Baltimore and New Haven. The new line will be devoted to freight carrying exclusively.

On July 1 the firm of A. A. & B. W. Parker took over the business of Parker & Millen of Detroit, and also the business of the Swain Wrecking Co.

THE SAN BLAS ROUTE.

A SUMMARY OF ARGUMENTS IN SUPPORT OF A SEA-LEVEL CANAL ACROSS THE SAN BLAS ISTHMUS—COSTS COMPARED WITH OTHER ROUTES—IT IS SAID THAT A SHIP TUNNEL WOULD SETTLE THE PROBLEM.

BY WM. W REDFIELD*

In 1889, on the 8th of May, the author had the honor of reading a paper entitled "San Blas Canal vs. Panama Canal, and Sea-Level vs. Locks." In that paper (published on page 345 of Vol. VIII of the Journal of the Association of Engineering Societies) he endeavored to state clearly the superiority of the location at San Blas over that at Panama, and also over that at Nicaragua, on the ground that "sea-level or nothing" (as the lamented de Lesseps himself declared) is the one thing needful to seek after. Such being the case, it follows that the Nicaragua route becomes necessarily excluded from consideration, for it is conceded by all that nothing but a lock system is possible for that route. This limits the discussion to the Panama route, and also to the route that is the subject of this paper, namely, the San Blas route, whose Pacific terminus is about 30 miles due east of the city of Panama.

Locks intrinsically are expensive. They necessitate a summit level that must be constantly supplied to full capacity with feed water. In their use considerable loss of time is incurred. On the other hand a sea-level canal requires an enormous quantity of excavation. This, however, is simply a matter of cubic yards, generally of rock at the deepest part of excavation through the backbone ridge or divide. Yet, when completed to sea-level, no loss of time ensues other than that due to formal delays in entering and leaving the canal and in passing the tidal locks, and also to the necessary slackening of speed in the passage. Now, if sea-level is so desirable, it is proper to ask, "What is the matter with the Panama route, only 49 miles long, having a maximum altitude of less than 400 feet above sea-level?" In reply, I would say that, in spite of these apparent advantages, newspaper reports, amply corroborated, have made us all aware of the floods from the Chagres river, largely undoing work as fast as it progresses. The line of canal closely follows the Panama railroad, and crosses the Chagres river and the Rio Grande many times. It is clearly seen how very difficult it is to control these rivers, especially when the canal becomes excavated below the present bottoms of these rivers. As we all know, the present plan is to abandon the sea-level project and have locks with a summit level of 125 feet altitude for a length of 21 miles. It is now claimed that on this basis the canal can be completed for a less amount of money than the sum already expended. And now comes the very point on which I advocate the San Blas route. This, I will show, can be completed on a sea-level basis for less than the sum necessary to complete the Panama canal on a lock-system basis. To present the merits of the San Blas route with comparative clearness I now rewrite a part of my previous paper on this subject. The San Blas route, whose Pacific terminus is only about 30 miles due east of the city of Panama, has been rarely mentioned, on account of one objection. This is a tunnel seven miles long. But what and where is this route? Let us examine it briefly. I have the honor to refer to the eminent W. W. Evans, in an article by him on the subject, from which I quote:

"I will confine myself to three predictions: First, that the de Lesseps canal, as a sea-level canal, will never be built; second, that the Nicaragua canal will be built, and by our own government or people; and, third, that when the great importance of this water line to the world, and more particularly to our world, is once proved by the Nicaragua canal, then there will be a sea-level canal built on the San Blas route, where it should have been built in the first place. It presents the shortest route from ocean to ocean; it can be cut in one straight line, without a curve; it is not on a line of drainage; it has good harbors at each end; it can be traversed in less than one day; it is in a comparatively healthy region; it has every point in its favor but one, namely, a tunnel big enough to pass a ship. And it has not yet got through the craniums of those wise men who have been sitting on this problem for so long a time, trying to hatch out something, that it is as easy to cut a ship tunnel as to cut a railway tunnel; they only differ in quantity. And, as regards this very tunnel, there is not as much rock to be removed as there was in the 'Des Aquadero,' near the City of Mexico, which the Spaniards cut merely as a precaution nearly 200 years ago, when their tools, their blasting compounds and their engineering knowledge were a mere bagatelle to what we now have at command."

I will now give a little information derived from an article in Van Nostrand's Magazine of June, 1869. A survey of the route was made in 1863, and a report in 1864, on behalf of Mr. Fred. M. Kelly and others of New York city, under the direction of A. McDougall of Massachusetts, now deceased, as chief engineer, and Charles A. Sweet of Syracuse, N. Y., as principal assistant. According to this survey, the length of route from coast to coast is 30.03 miles. It extends from Chepillo island on the Pacific coast (about 30 miles east of Panama) to the Gulf of San Blas on the Atlantic side. For convenience, the work may be divided into four sections.

Section 1 extends from Chepillo island to "Paneas," on the Bayano river, and is 10.101 miles long. Work required—a composite dam across the river at the Great Bend of the same; a tidal lock at the Great Bend with walls 45½ feet high; a short canal cut across the Bend; removal of sandbars in Pacific harbor and in Bayano river, and a light-house at Chepillo island. Estimated cost, including draining, chopping, earth and river excavation, embankment, masonry, labor, materials, etc.: Removal of bars, $136,684; light-house, $12,000; tidal lock, $675,844; composite dam, $174,631; Great Bend cut, $209,835; total, $1,208,994.

Section 2 is a canal from Bayano river at "Paneas" to the south end of tunnel, and is 8.996 miles long. The work consists of the canal proper, and a new channel for the Mamoni river (crossed by route of canal), about 3.6 miles long. Estimate of cost: Canal, inclusive of bailing, draining, chopping, excavation, embankment, puddling, etc., $13,033,943; new channel for Mamoni river, $115,752; total, $13,149,695.

Section 3 is a tunnel through the Cordilleras seven miles long. This is exclusively rock excavation. It consists of a canal of 25 feet depth of water, a perpendicular excavation of 29 feet above water surface on either side, from which springs an arch, forming the roof, and sufficiently high to pass over and clear the tallest masts. This section at $2.50 per cubic yard is estimated at $29,316,067.

Section 4 extends from the north end of tunnel to 25 feet depth of water in the Gulf of San Blas on the Atlantic side, and is 3.073 miles. The work consists of the canal proper, a lock with 9 feet fall and walls 38½ feet high, and a light-house on San Blas point. Estimate of cost is: Canal, $11,234,318; lock No. 2 or lift-lock, $506,017; light-house, $12,000; total, $11,752,335.

SUMMARY.

Section	1	equals	10.101	miles	at an estimated	cost	of	$ 1,208,994
"	2	"	8.996	"	"	"	"	13,149,695
"	3	"	7.000	"	"	"	"	29,316,067
"	4	"	3.073	"	"	"	"	11,752,335
Total		equals	29.170	"	"	"	"	$55,427,091
Engineering and contingencies (10 per cent.)								5,542,709
Medical and military aid, etc., interest on capital during construction and transportation								32,500,000
Total								$93,469,800

This estimate is based upon a canal having (except in tunnel) a surface width of 143 feet; at the bottom a width of 100 feet, and 25 feet depth of water. A second and cheaper estimate, on a smaller size of canal is also given, which I shall not here repeat. Summed up, the general facts are: Entire route, except near the mountains, is nearly level; summit of Cordilleras varies under and over 1,200 feet above the sea; entire canal to be fed from Pacific ocean, and water maintained at the level of ordinary high tide on the Pacific side. Tides on the Pacific side rise from 12.65 to 22 feet for highest. On the Atlantic side there is from 1 to 1½ feet from ebb to flow.

In an article in the Journal of the Association of Engineering Societies for August, 1886 (Vol. V, pages 367 to 382), it is stated that an approximate estimate of work done on the Panama canal and work still to do to complete the same in eight years (1894) amounts in round numbers, with interest on same, to a total of $800,000,000. Now put these figures (amended by a lessening of amount to suit the transformation of basis from sea level to lock system) against the preceding estimate for the San Blas route, and there is no doubt as to the best route. Take alone Mr. Evans' reasons, "that it is not on a line of drainage; no Chagres problem to contend with; a good harbor at each end" (the Panama terminal harbors have been artificially constructed—1900), and these coupled with his other reasons, are sufficient to favor the San Blas route.

And now what about the chief objection to said route, namely, a tunnel large and tall enough to float the largest ships? Is that enough to condemn a route when every other argument is in its favor? Has not the science of tunneling advanced to such an extent in the last half century as to overcome most obstacles? Then, too, the work in tunnel is admirably suited to a tropical climate, because work can be uninterruptedly performed in all weathers. A temporary auxiliary railroad can easily be provided to haul tunnel contents to either end for filling. A stream crosses the line of tunnel in a depression between two ridges of the Cordilleras. This possibly might be utilized to generate electricity for lights to be placed in the tunnel when completed. The head above the canal is sufficient to give the power to a small turbine placed in a shaft sunk to one side of the canal, and receiving water through a pipe from said stream and passing same in pipe down the shaft to the turbine, and then outletting the tail race pipe into canal, thus generating the power to drive dynamos for electric light in the tunnel.

The "line of no drainage" is all-important, even if the divide has an altitude of 1142 feet above the sea, instead of less than 400 feet, as on the Panama route. The greater quantity of dry excavation, or at least the non-interference of any such river as the Chagres, will, I am sure, be found far less expensive totally than a ridge of half that altitude, but reeking with moisture, and, as work progresses, to far below the level of adjacent rivers that must be taken care of, and whose elevation is far above the canal; and the danger ever present of sudden floods (peculiar to the rivers of the isthmus) driving every barrier away and undoing in a few minutes the work of many months.

With the political phases of the question I think the engineer has but little to do. Still, we may not ignore them, for political reasons and urgencies point out very clearly the comparative merits of various routes. For instance, in our late war with Spain, when our fine vessel, the Oregon, was beating her own record from the Pacific through the Straits of Magellan to reinforce our gallant navy in the Caribbean sea, and running the danger of encountering the Spanish fleet of Cervera, thousands of miles would have been saved, as well as valuable time. One day would suffice for passing through the sea level-canal of San Blas. A longer time than one day would be required for a Panama sea-level canal; still longer for a Panama lock canal, and longer yet for Nicaragua. Even admitting that Nicaragua is a longer route, and that three or four days might be necessary there, compare even the Nicaragua route with the longer journey around South America, and none could deny that we must have a canal of some sort. I am very hopeful of the commission now investigating by surveys of territory contiguous to all three routes. If their work is properly done (and I believe it will be) data may develop that may produce and show clearly a better route; that is to say, the San Blas route, or even a better one not far from the same. The commission, I understand, will spend some time at their labors, and when finished the result of their topographical researches will be awaited with great interest and eager expectations.

An additional reason for the San Blas route is the fact that it can be built on a straight line from ocean to ocean, certainly a very desirable advantage. Now let us imagine the San Blas route to be fully completed, with the exception of the 7 miles of tunnel. Is it possible that if $29,000,000 is all that stands in the way of puncturing this backbone that the United States would hesitate on account of that comparatively nominal sum? Leaving interest and extras out of consideration the combined three sections, other than tunnel, would cost $26,111,024, thus showing the tunnel section to cost but little more than one-half of the whole canal. Besides, being on a line of no drainage, and not inordinately troubled with water, an open cut (of ample width above the rock portion) could properly be considered as an improvement on the tunnel. What a magnificent example of engineering it would be! Short, straight, on the level of the sea, a "straight Straits of Magellan!" No detention from flights of locks, except the tidal locks at each end, indispensable on any inter-

*Mr. Redfield is a member of the Engineers' Club of Minneapolis. His paper is reprinted from the Journal of the Association of Engineering Societies.

oceanic canal. Simple, direct, cheaper to entirely build to a sea level system now (including a tunnel 7 miles long) than to complete the remaining portion of the Panama canal to a lock system only; illustrating the fact that sometimes it is wiser to throw away part of a partially good thing and replace with an entirely new and good thing that can be built for less cost and give better service than the thing abandoned. I also believe that the straight-line feature would safely permit greater speed to vessels in passage; the steering would be easier, and less side wash would result against the banks. In conclusion, I give a few extracts from an article in the Minneapolis Evening Journal by Mr. W. W. Jermane. His arguments in favor of the Panama route are what I will quote, and they apply with equal or greater force to the San Blas route. The advantages of the Panama route, he says, are:

1. The shorter length, a most important consideration. The proposed Panama canal is 47 miles from sea to sea, while the Nicaragua is 189 miles long. (The San Blas route is 29.17 miles long.)

2. The existence of a railway parallel to the canal and considerable progress upon the work, each of which factors would secure the early completion of the canal. (A railway sufficient for construction purposes is easily built along the San Blas route.)

3. It is claimed there is less danger of earthquake disturbances on the Panama route, and there exist more careful data as to rainfall and in the way of borings and necessary information as to geological formation. (The San Blas route is so near to Panama route that the same reasons will probably apply largely at the former location.)

4. The possibility that improvements in engineering and excavation may ultimately give us a sea-level canal. (On the San Blas route nothing but a sea-level canal is proposed.)

5. Much better harbors at two ends. (Equally true on San Blas route, where harbors already exist, and a line between them "straight as a crow flies" is proposed.)

"Any person who carefully considers the situation must realize that there is enough of question between the two routes" (and also the San Blas route) "to justify careful examination and brief delay. The commission of engineers appointed by the president to examine it will be ready to report in a few months. Should their recommendations be unanimous it would be useless for the advocates of either" (or any) "route to contest the validity of their decision. The commission is made up of men of character and ability."

With the foregoing quotation I end this paper, and desire to say, without ostentation, that I believe the reasons I have presented in favor of the San Blas route are cogent and worthy of careful consideration.

A STORY OF MARINE GLASSES.

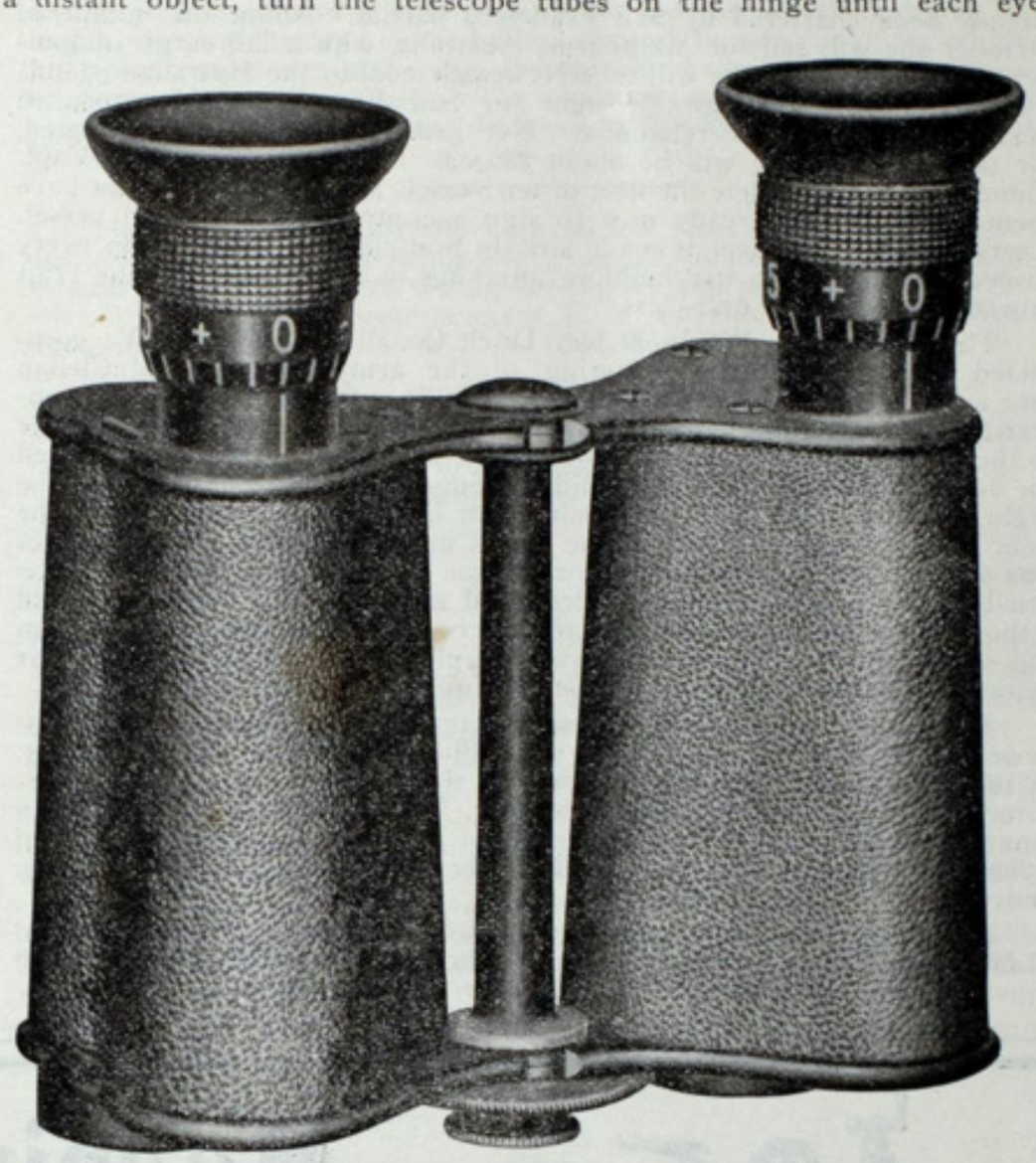
THEIR DEVELOPMENT THROUGHOUT THE PAST CENTURY—NEW FORM OF GLASS JUST PUT UPON THE MARKET BY WARNER & SWASEY, FAMOUS TELESCOPE MAKERS OF CLEVELAND.

For many years the glasses upon which every captain relied were long, clumsy and cumbersome telescopes. On account of their size and weight they were always single-barreled—to use with one eye only. Early in the present century the shorter double glasses of the Gallilean form and called "binoculars" were introduced and here progress halted again. These glasses were open to many objections. A surprisingly large percentage of people were able to see clearly without one eye at a time, owing to a difference in the two eyes of the individual, or the fact that the difference of the pupils of their eyes varied greatly and the glasses were made to fit the average distance of certain people of certain nations. The average pupillary distance of a given number of Frenchmen is slightly wider than that of Americans. Hence, in using French glasses, many Americans could center but one eye at a time, and the other eye being out of center, a confused image or even two images, was the result when both eyes were used. The focus of the lenses was short and the lenses large, and in high powers a large amount of light was absorbed, so that only a small part of it could fall upon that part of the eye which received the image. This restricted the user to low powers, as the illumination decreased with the rise in power, and seamen found that a smaller, well-lighted image was more serviceable than a large but very dim one. Practice settled the fact that about six diameters was the most serviceable image that could be attained with the Gallilean form of binocular. Here progress stopped until 1895, when Carl Zeiss of Jena took up the problem.

Great progress had been made by that time in the production of optical glass and Zeiss therefore used lenses of much stronger focus than usual and inserted a pair of prisms, which, while erecting the image, reflected the light back and forth in such a way that a 9-inch focus was folded up to bring the eye piece about 4 inches from the object lens, thus shortening his barrels about 5 inches and greatly increasing the light efficiency of the instrument. He also made the pupillary distance adjustable. The high grade of optical and mechanical skill required for the new form resulted in an expensive glass. It costs about four times the amount of the old pattern. Notwithstanding this, it was eagerly welcomed on account of its much larger field, perfect definition and increased light efficiency. French, English and American manufacturers seized upon the new idea and began its manufacture under royalty.

Finally Warner & Swasey of Cleveland, O., the largest telescope makers in the world, took up the problem from an engineering and optical standpoint, with the object of still further increasing, if possible, the efficiency of the porro-prism form of marine and field glasses. They produced the glass shown in our illustration, which is full size. The total number of pieces it contains is less by twenty than will be found in any other instrument of similar type. This feature does not limit its use, efficiency or convenience in any way, but is the result of scientific design and insures added strength, lighter weight and greater convenience for the user. A letter from Warner & Swasey thus describes the new glasses:

"By arranging the triple tubes so that the hinge is very close to the barrels strength is gained; and by combining the caps and hinge in single pieces all liability of the alignment changing by accident or rough usage is avoided. In fact the design and method of construction are such that the instrument can be taken apart and reassembled without change in adjustment, a result which we believe has not been attained by any other makers. The eye-piece cases are graduated and numbered from 0 in each direction+and—. When set at 0 the instrument is in correct adjustment for normal eyes for any object above 50 yards distant. To suit vision varying from the normal, the eye-pieces may be turned to right or left until the object observed is clearly defined. This adjustment should be made for each eye separately, and, once determined, will always be correct. The pupillary adjustment is made by turning the tubes of the telescope on the hinge which connects them, thereby insuring a choice ranging from 2¼ to 2¾ inches center distance between the eye-pieces. As finally inspected before leaving the factory all field glasses are adjusted for the average distance of about 2½ inches. When turning the tubes on the hinge, the effect of the spring catch will be readily noticed by increased friction at one point. Should a different adjustment be required this spring catch may easily be set for any required distance. To do so loosen by means of the steel pin supplied with the leather case the perforated screw-head forming one end of the hinge; then, while observing a distant object, turn the telescope tubes on the hinge until each eye



WARNER & SWAZEY FIELD GLASS, ACTUAL SIZE; POWER 8 DIAMETERS; FIELD 4¾ DEGREES; WEIGHT 11 OUNCES.

obtains a full and clearly defined view of the field. A good test is made by alternately closing and opening each eye. When the desired result is obtained be sure that the notch in the milled washer coincides with the spring catch above mentioned, and then tighten the screw firmly. This adjustment, carefully made, will obviate the necessity of determining the interocular distance each time the instrument is used; for the correct position once found, is afterwards mechanically secured by the spring catch. The general design of the instrument is so symmetrical that its contour is but slightly changed by any of these adjustments. It will therefore fit its leather case exactly as it is used. This feature will be especially appreciated by those who must use the instrument quickly or with but one free hand."

A test made of this and the ordinary glass showed that an adjustment of 9-16 of an inch in the focus was necessary for two persons of different sight with the Gallilean pattern of glass. Neither could see anything when it was adjusted for the other. Only 1-16 inch adjustment was necessary to focus the new glass for the same two observers and each could see well with the glass adjusted for the other. This test was made with a near object. With distant objects practically no adjustment was necessary. The new glass covers a field of 4¾ degrees with a power of 8 diameters and it has received the approval of the army and navy departments, and large numbers of them have been purchased by the government. Several large orders have been placed with the Cleveland firm by lake and Atlantic transportation companies. Anyone who compares the new and old patterns carefully will be greatly pleased at the great difference between them and will readily pay the difference in price.

GOVERNMENT CONTRACTS.

Col. Jared A. Smith, United States engineer at Cleveland, announces elsewhere in this issue that sealed proposals for removing and rebuilding part of the west pier at Huron, O., will be opened at his office in the Hickox building at 2 p. m. Saturday, July 21.

Proposals for improving the harbor at Brazos Santiago, Tex., by hire of dredging plant will be opened June 30 by Capt. C. S. Riche, United States engineer at Galveston, Tex.

Aug. 10 is the date fixed for the opening of proposals for furnishing armor to the navy department. The contract will be the largest ever let for armor. Forms of proposals and all necessary information may be obtained from the chief of the bureau or ordnance, navy department.

In order to launch the two large steamers which are being built at Roach's Ship Yard for the San Francisco-Hawaiian line it will be necessary to dredge the river along the front of the plant.

ATLANTIC AND PACIFIC COASTS.

A RESUME OF OPERATIONS AMONG THE VARIOUS SHIP BUILDERS—GREAT ACTIVITY AMONG BUILDERS OF WOODEN VESSELS IN MAINE.

The Moran Bros. Co. of Seattle, Wash., has entered into contract to construct a $60,000 sailing vessel for Capt. E. E. Caine and others. This is the second of a fleet of ten which will be built for the same owners. The first contract calls for a four-masted schooner, and this craft is nearing completion. The frames are in position and the vessel is being ceiled. She will be completed and in commission about Oct. 1. The vessel just contracted for is to be a four-masted barkentine. She will be ready for service late in October. Her general dimensions are: Keel, 196 feet; beam, 41 feet; depth of hold, 16 feet. She will have a lumber carrying capacity of 1,250,000 feet. The schooner, which has not been named, has already been chartered by San Francisco parties. About the middle of October she will sail for Melbourne, Australia, with a full cargo of lumber. From Australia she will take Newcastle coal to the Hawaiian islands —there securing a cargo of sugar for San Francisco—and return to Seattle with general merchandise. Her gross earnings, it is estimated, for the entire voyage will be about $30,000. "It is our purpose," Capt. Caine says, "to complete the fleet of ten vessels as quickly as we can have them built. We are ready now to sign a contract for the third vessel. Every vessel of the fleet is made strictly first-class and modern in every respect. There is no use building anything in the way of marine craft nowadays unless it is first-class."

The Morse Iron Works & Dry Dock Co. of Brooklyn, N. Y., completed the rebuilding and altering of the army transport McClellan into a first-class troop ship within the time specified in the original contract, notwithstanding that many changes and additions were made to the original specifications. To complete the work in the time specified the contractors had to ignore holidays, Sundays and the darkness of the night, and the alterations and repairs went on without cessation from the hour the ship was delivered at the works until completed. The contract was a most arduous one and the ship was stripped completely and was fitted up in the new with masts, deck and saloon fittings, new decks and a thorough repairing of engines and boilers. As she was turned out from the shops of the company she was complete in every detail and a far better vessel than when she left stocks originally.—Maritime Register.

Keel of the copper-sheathed, steel-protected cruiser Denver has just been laid at Neafie & Levy's ship yard, Philadelphia, and as 90 per cent. of the material for the hull is already in the yard the work on the warship will be rushed throughout the year. The vessel will be 292 feet in length, will have an extreme breadth of 44 feet, with displacement of 3,200 tons at 15 feet 9 inches draught. She will have a speed of 17 knots, and the cost will be $1,080,000.

Following is a list of wooden vessels built in the ship yards of Maine during the past six months: Schooner Helen W. Martin, 2,300 tons; schooner Calumet, 1,100; schooner Henry Weiler, 400; schooner Mary W. Bowen, 2,156; schooner Marie Palmer, 1,904; barge Iowa, 1,800; barge Elk Garden, 742; barge Benevadies, 920; barge Black Diamond, 920; barge Hampshire, 840; barge Sharon, 475; barge Norton, 475; barge Georgia, 1,488; barge Bee, 900; barge Flora, 825; barge Indiana, 1,609; steamer transfer No. 13, 375; steamer transfer No. 14, 375. This makes a total of eighteen vessels launched since Jan. 1, or a combined tonnage of 18,609. The season in Maine promises to be the heaviest in years, even though the total for 1899 was considerable.

The Cornell Steamboat Co.'s two 75-foot steel tugs, building at Newburgh, N. Y., will be called the George W. Decker and the John B. Rose, and the New York Central & Hudson River Railroad Co.'s two 105-foot steel tugs, building at the same place, will bear the names of Depew and Calloway. All four tugs will have compound engines.

Robert Dollar, California ship owner, has ordered a steel steamer to be built at the new works of the New York Ship Building Co., Camden, N. J. The keel has already been laid. The vessel will be 326 feet long, 40 feet beam and 26 feet in depth. She is to be delivered on the Pacific coast early next year.

Secretary Long has made the second payment on account of the construction of the cruiser Cleveland to the Bath Iron Works. The Cleveland is further advanced than other vessels of her class and the officials of the navy department are gratified at the progress being made by her builders.

The ferry boat John Englis, recently launched by T. S. Marvel & Co., will have a sister boat in the Henry B. Hollis. Both boats, which will be ready in the fall, are being constructed by the W. & A. Fletcher Co., Hoboken, N. J.

The Bath Iron Works, Bath, Me., is repairing the wreck of the Standard Oil Co.'s steamer Maverick by day work. It will take three months to put her in good condition and the cost will be about $60,000.

Bids will be opened shortly by the Chesapeake & Ohio Railway Co. for a passenger steamer to ply between Newport News and Norfolk. The William R. Trigg Co. is quite desirous of getting the contract.

Work is now being hurried forward at Millbridge, Me., on the two-masted wooden schooner Gamma, which is in process of rebuilding by her new owners, E. W. Wallace and others of that town.

Plans have been ordered prepared for building the new stone and concrete dry dock at New York. The dock is to accommodate ships drawing 31 feet of water and will cost $1,000,000.

Percy & Small, Bath, Me., will soon begin work on a four-masted wooden schooner for Capt. E. D. Atkins. The firm will also shortly stretch the frame for a five-masted schooner.

Material has already arrived at the yard of Arthur Sewall & Co., Bath, Me., and a crew of men have begun work on the frames of the two Standard Oil steel shipentines.

E. S. Bowker of Phibsburg, Me., is building a three-masted wooden schooner and C. V. Minott of Phibsburg Center, Me., is constructing a four-master.

RULES FOR CHICAGO RIVER NAVIGATION.

City officials in Chicago are at work on a new set of rules to govern navigation in the river. A commission, of which City Engineer Ericson is chairman, has submitted a report containing the following provisions:

The bridges to be closed week days on the main river and south branch as far as Twelfth street between 6 and 8 a. m. and 5 and 7 p. m. On the south branch between Twelfth and Halsted streets and on the north branch between Kinzie and Halsted streets, 6 to 7 a. m. and 5.30 to 6.30 p. m. All other bridges 6 to 7 a. m. and 6 to 7 p. m. No bridge shall be kept open more than ten minutes at a time between 6 a. m. and midnight.

All boats are prohibited from approaching nearer than 100 feet to a bridge until the signal is given that the bridge is to be swung. The city harbor master is required to keep a record of all damage done to bridges by boats. No vessel will be permitted to lie alongside or lap another in that portion of the river lying between Rush street and Halsted street on the south branch and North avenue on the north branch. A fine of $10 to $100 is provided for vessels that block the channel, and where vessels are moored in such a position as to impair navigation in the river they will be removed by the harbor master at the expense of the owner.

The minimum speed of vessels in passing through bridge draws is fixed at two miles an hour. Vessels moving with the current shall be given the right of way. Vessels exceeding 200 tons shall be limited to a speed of five miles an hour. All vessels not propelled by steam shall be towed by one or more tugs.

SEVERAL STEAMSHIP LINES CONSOLIDATE.

The Manhattan Steamship Co., with offices at No. 11 Broadway, has been incorporated under the laws of Delaware and is capitalized at $600,000 7 per cent. preferred stock and $600,000 5 per cent. common stock. It will comprise the following lines: New York & Portland Line, for Portland, Me.; New York & Bangor Line, for Rockland, Camden, Belfast, Bucksport and Bangor, Me.; New York & Halifax Line, for Yarmouth and Halifax, N. S., Cape Breton and Prince Edward's island; New York & Cottage City Line, for Cottage City, Mass.; New York & St. John Line, for Bar Harbor, Eastport and Calais, Me., and St. John, N. B.

The company will have six steamships and expects to have the various lines in operation by Sept. 15. Each steamship will have accommodation for from 50 to 150 passengers, and the freight capacity of each vessel will range from 1,000 to 1,800 tons. Richard Morrell has been elected president of the company, with former United States Treasurer James N. Huston as treasurer. The other members of the board are Seth L. Larrabee, Hon. William Pugsley, Samuel M. Brookfield, Gen. S. D. Leavitt, Henry McLaughlin, Alvah Trowbridge, W. H. Kimball, J. Howard Sweetser, Alden S. Swan, I. G. T. Martin, G. Waldo Smith, John Hinchcliffe, William McKenzie, Edward F. Cragin, James W. Cunningham, S. H. Howe, George E. Green, Frank Presbrey, Walter J. Dunham and D. L. Walbridge.

EQUIPPED TO BURN OIL.

The steamer Cardium, built by Sir W. G. Armstrong, Whitworth & Co., Ltd., and engined by the North Eastern Marine Engineering Co., Ltd., at their Northumberland Engine Works, Wallsend-on-Tyne, which vessel in common with her sister ship, the Strombus, enjoys the distinction of carrying the largest cargo of oil of any steamer yet launched, was taken to sea recently for the official trial. More than usual interest was manifested from the fact that out of three boilers with which the vessel is fitted liquid fuel was used in the one and coal in the other two. The vessel was taken for a series of runs over the measured mile, and the mean speed observed was nearly 11 knots, or nearly half a knot more than the sister ship, the Strombus, which was tried with coal fuel in all the boilers, this increase being due to the larger power which could be generated and maintained by the boiler in which liquid fuel was employed. After the trial had been completed, a very interesting illustration of the facility with which the boilers could be transformed from oil burning to coal was made, and in one hour and a quarter after the operations of changing were begun, the four furnaces of the boilers were all burning coal, the oil burning apparatus was stowed away, the stokehold cleared, and the ship was ready to resume the voyage. The apparatus for liquid fuel, which was used in the forward boiler, was designed by Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd.

VALUE OF STOCKS—LEADING IRON AND STEEL INDUSTRIALS.

Quotations furnished by HERBERT WRIGHT & Co., Cleveland, date of July 11, 1900.

NAME OF STOCK.	OPEN	HIGH	LOW	CLOSE
American Steel & Wire.....	33½	33½	32½	32½
American Steel & Wire, Pfd.....	73	73	72⅛	72¾
Federal Steel	33¼	33⅞	32¼	33⅞
Federal Steel, Pfd.....	67	67	66¼	67
National Steel	23¼	24	23¼	24
National Steel, Pfd.....	84¼	84½	84¼	84¼
American Tin Plate	21½	21½	21	21
American Tin Plate, Pfd.....	74⅞	.....	.....	74⅞
American Steel Hoop.....	19⅞	20¼	19⅞	20¼
American Steel Hoop, Pfd.....	68	.....	.....	68
Republic Iron & Steel	11⅜	11¾	11⅜	11⅝
Republic Iron & Steel, Pfd	56½	57	56	56

PERSONAL.

Mr. A. B. Holmes, who has been connected with the Standard Pneumatic Tool Co. of Chicago since its organization, has been appointed assistant manager of the company, and will be located in the Marquette building, Chicago. The Standard company has opened offices in Pittsburg, 217 Ferguson building, and Mr. Wm. Jennings will have complete charge there.

Herbert C. Sadler, the newly appointed professor of naval architecture at the University of Michigan, is well known in this country, a large number of assistant naval constructors and young American ship builders having been associated with him at Glasgow, Scotland. He is about thirty years of age, a deep student and with a pleasing personality. His large and varied practical experience besides his extensive knowledge of theoretical naval architecture, should make him admirably fitted for the position which he is about to fill.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Co., Chicago, Ill., who returned to Europe July 3 on the Kaiser Wilhelm der Grosse, for an extended stay at the Paris exposition, invites customers and friends of the company who visit the exposition to call on him at the company's exhibit in the American machinery building, Vincennes, in space 1, block 9, or at the palace of machinery and electricity, Champ de Mars, space 1, block 14, where he will be pleased to meet them and extend any courtesies in looking up points of interest.

Charles Schofield has severed his connection with the Wm. Cramp & Sons Co. of Philadelphia and has accepted a position as yard superintendent with the Eastern Ship Building Co., New London, Conn. Mr. Schofield has been employed in responsible positions by the Detroit Dry Dock Co., F. W. Wheeler & Co. and the Harlan & Hollingsworth Co., and for four years he was associated with Messrs. Hanscom and Fairburn at the Bath Iron Works. Mr. Schofield is one of the best practical iron ship builders in the country. He has had a broad experience in European and American ship yards.

New London (Conn.) papers report that William A. Fairburn, naval architect and assistant manager of the Eastern Ship Building Co., with two other well-known employes of the company, rowed from Norwich to New London, July 4, a distance of 14 miles, in the fast time of 1 hour and 42 minutes, against tide and with wind abeam. The previous record of 1 hour and 55 minutes was made in a large ten-oared gig, whereas Mr. Fairburn's boat was only 14 feet long and of his own production. A speed of 8¼ miles an hour in a small boat which contained four persons, three of whom were pulling, is a remarkable performance. The boat weighed 120 pounds, the three oarsmen 440 pounds, and each pulling two long oars, and the coxswain 80 pounds, a total of 640 pounds.

The Portland Ship Building Co., South Portland, is building a yacht for James C. Jordan of South Portland, Me.

THREE NEW WOODEN VESSELS.

On the Penobscot river at Bucksport, Me., three wooden vessels are being built by a New York firm, McKay & Dix, who have leased what is known as the Verona yard. One of them, a four-master of 1,400 tons, is in frame, and beside it is a 750-ton bark, while between the two workmen are stretching the keel for another four-master, a twin sister, to be built on the same molds as the big one.

The four-masted vessel is designed to be a large carrier. Her iron keelson is flush with the ceiling, her houses will be above deck, so that the hold will be broken only by a spar deck and the masts. The model is very "long-legged" and almost flat bottomed. At present almost the whole force of the yard are at work on the bark now being ceiled and receiving the deck timbers. The vessel is wanted for the cryolite trade and must be launched by August 15, if possible. She is being built very strong, her ceiling being the same as is used on the four-master. A large amount of material is on hand, far ahead of the immediate wants, and ore arriving daily. The firm want twenty or thirty more carpenters and it is the lack of men which is delaying the framing of the second four-master.

When this concern took the old Beazley yard a few months ago there was little in the way of buildings or other facilities. The old ways from which the last vessel, the Norombega, slipped in 1882, were rebuilt and strengthened. Two new ways were constructed and much and expensive cob-work built. A steam mill building has been built which contains a large boiler and engine operating a heavy planer and large rip saw with power feed. The boiler also furnishes steam for the steam box for bending planks and for a Hyde windlass, which has been set up at the head of the ways, and handles the heavy timbers. The blacksmith shop is now running four fires constantly, and in addition a galvanizing plant has been established, an arrangement of vats in which the iron work is dipped and coated with the white metal.

The spar makers are already at work in the yard. The rough sticks are nearly all at hand and a number of topmasts, booms, gaffs and yards have been completed. Four masts recently brought across the continent from Seattle, Wash., are handsome sticks of Oregon pine 118 feet long. They come rough-hewn. The masts for the bark and bowsprits for all three craft were in the Pacific coast consignment. While the occupation of the Verona yard by McKay & Dix is presumed to be temporary and for the purpose of building the three ships only, it is reported that the chances are that considerably more than these vessels—possibly a five-master—may be put up next year.

CHARTS OF THE ST. LAWRENCE.—It frequently happens that owners of steam yachts passing between the lakes and the Atlantic want charts of the St. Lawrence river, and want them in a hurry. The Marine Review has them on hand all the time—complete from Lake Ontario to the Gulf of St. Lawrence.

DUTIES OF THE NAVAL ENGINEER.

Forty years ago the duties and responsibilities of the naval engineer officer were confined to the care, maintenance and manipulation of the engines, boilers, pumps, pipe connections, the sluice valves between the compartments, and all sea-inlet valves. Some conception of the onerous duties and vast responsibilities which now devolve upon the chief engineer of a modern warship may be obtained from a perusal of the following extract from the British regulations, stating the items of machinery and parts of the ship which are placed in his care, and for which he is held personally responsible.

1. The machinery and boilers of the ship and boats (the Terrible and Powerful have forty-eight boilers and 25,000 indicated horse power engines, and cruisers are now building with 30,000 indicated horse power engines; many ships have four steamboats).
2. All auxiliary machinery, for whatever purpose fitted.
3. All pumps, with the pipes, cocks and valves belonging to them.
4. All distilling apparatus, etc.
5. All gun mountings and torpedo carriages.
6. Propeller lifting apparatus.
7. All steam and hydraulic, pumping, and other engines for loading and working the guns, for supplying ammunition, and for turning turrets, barbettes, platforms, etc.
8. All ventilating engines and gear.
9. Capstan engines, shafting and spindle of capstan and windlass, and steam-steering engines and steering gear as far as the rudder, with spare gear for the same.
10. Hydraulic jacks, with exception of those in the gunner's charge.
11. Steam winches and gear for hoisting in torpedo and other boats.
12. All watertight doors and sluice valves, including horizontal trap-and-flap doors, as well as vertical hinged doors.
13. Steam fire engines, and all pipes, cocks and valves in connection with the fire main.
14. Instruments and gear for telegraphing signals in connection with the machinery.
15. Whitehead torpedoes, submerged discharge tubes, and gear for torpedoes.
16. All air-compressing machinery, reservoirs, separators and charging columns.
17. Electric light engines and dynamos.
18. All flooding gear, including valves, cocks, pipes and other fittings.
19. Refrigerating machinery.
20. All such other parts of the hull, double bottoms, and exposed iron surfaces as may be in his care, either wholly or jointly with other officers.

In addition to the above, the regulations also state "that the chief and other engine-room artificers, and chief and other stokers, are to be under the immediate direction of the engineer of the respective watches, the engineer officer to be responsible for the general decorum, good order and cleanliness of the engine-room, and he will see that the engineers and the other persons employed under his control perform their duties with promptitude and to the best of their abilities." Duties of an executive nature connected with evolutions and inspections of the engine-room ratings and their clothing, also devolve upon him, and make an appreciable demand upon his time.—Engineering, London.

LAUNCHES IN LAKE YARDS.

A three-masted wooden schooner, known as "No. 94," will be launched from James Davidson's ship yard at West Bay City in about three weeks. The vessel is 350 feet in length, 45½ feet beam and 27 feet deep. She will have a carrying capacity of 5,000 tons, will be equipped with steam windlass, deck hoists, pumps and siphons, have stockless anchors and be steered by hydraulic power. A wooden steamer is also well under way at the Davidson yard and will be ready for launching in September. She will be of Canadian canal dimensions, 257 feet long, 42 feet beam and 24 feet deep.

Another of the new steamers for the Pittsburg Steamship Co. (Carnegie) has been launched by the American Ship Building Co. and will be in commission shortly. The vessel is the Cornell, built at the South Chicago yard. Alike to other new steamers of the Carnegie fleet, the Cornell is 474 feet over all, 50 feet beam and 28½ feet moulded depth, capable of carrying about 7,000 gross tons on 18 feet draught. Engines are quadruple expansion, the cylinders measuring 18, 26¾, 41 and 63 inches diameter and 42 inches stroke. Boilers are of the Babcock & Wilcox water tube type. The horse power is about 1,950.

It is expected that Capt. James Davidson's new dry dock at West Bay City will be finished Sept. 1. The dock will be 440 feet long and will admit a boat 60 feet wide.

TRADE NOTES.

"Home Endorsements" is the title of one of the many interesting pamphlets sent out by the International Correspondence Schools of Scranton, Pa., originators of correspondence instruction in the engineering trades and professions. The pamphlet contains some twenty-five or thirty letters from bank officials, pastors of churches, municipal and county officials, judges and others, all endorsing the work of the schools in the strongest possible manner.

Few concerns in this country spend money for advertising more judiciously than the Joseph Dixon Crucible Co. of Jersey City, N. J., and probably none of its specialties is more fruitful of results than the combination calendar and blotter sent out about the first of each month. These blotters are not of the kind that are thrown into the waste baskets and the regularity with which they are distributed serves to keep the name "Dixon" in the mind of everybody who receives them.

Following is an extract from a letter received recently by the Buffalo Forge Co. from the Verity Plow Co., Ltd., of Brantford, Ont.: "Replying to inquiry regarding down-draft forges installed by your company in our new works, we take great pleasure in stating that they have given the very best satisfaction. Our shop is entirely free from smoke and gas and we consider this style of forge very much in advance of the overhead draft."

The Northern Pacific Railway Co. has specified Bethlehem nickel steel for driving axles and crank pins for twenty locomotives now under contract with the Schenectady Locomotive Works, and the Bethlehem Steel Co. has already booked orders for the forgings in question. The Bethlehem company reports that the list of railroads using this material is steadily growing, but calls attention to the fact that those wishing to specify it for locomotive forgings should be careful to designate it as "Bethlehem nickel steel," as the reputation gained by the Bethlehem product has resulted in the production of inferior imitations which do not show the same high qualities.

"A MANUAL OF NAVAL ARCHITECTURE," by Sir Wm. H. White, director of naval construction in England, is one of the best-known books of its kind in the world. A fifth edition, revised and largely rewritten, is just out. It is a text book for students of naval architecture. Price $9. The Marine Review Publishing Co., Perry-Payne building, Cleveland.

Sealed proposals for furnishing armor for naval vessels will be received at the Navy Department until 12 o'clock, noon, August 10, 1900, when they will be publicly opened. Forms of proposals and all necessary information may be obtained from the Chief of the Bureau of Ordnance, Navy Department, Washington, D. C. F. W. Hackett, Acting Secretary. 6-18-1900. July 28

U. S. Engineer Office, Galveston, Tex., July 10, 1900. Sealed bids, in triplicate, for Improving Harbor at Brazos Santiago, Tex., by hire of dredging plant, will be received until 2 p. m., July 30, 1900, and then publicly opened. For information apply to C. S. Riche, Capt., Engrs. July 26

U. S. Engineer Office, 185 Euclid Ave., Cleveland, O., June 21, 1900. Sealed proposals for Removing and Rebuilding Part of West Pier at Huron Harbor, Ohio, will be received here until 2 p. m., standard time, Saturday, July 21, 1900, and then publicly opened. Information furnished on application. Jared A. Smith, Col., Engrs. July 19

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American Steel & Wire Co.....Chicago.

HEATING APPARATUS.
Sturtevant Co., B. F.....Boston.

HOISTS FOR CARGO, ETC.
American Ship Building Co.....Cleveland.
Brown Hoisting & Conveying Mach. Co..Cleveland.
Chase Machine Co.....Cleveland.
Donohue & Co., John T.....Baltimore.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co... .....New York.
Hodge, S. F. & Co.....Detroit.
Hyde Windlass Co.....Bath, Me.
Lidgerwood Mnfg. Co.....New York.
McMyler Mnfg. Co..... .....Cleveland.
Marine Iron Co.....Bay City.
Sprague Electric Co..... .....New York.
Westinghouse Electric & Mnfg. Co.... ...Pittsburg.

INDICATORS FOR STEAM ENGINES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

INJECTORS.
Jenkins Bros.....New York.
Penberthy Injector Co.....Detroit.

INSURANCE, MARINE.
Brown & Co.....Buffalo.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Gibbs & Joys..... .....Milwaukee.
Hawgood & Moore.....Cleveland.
Helm, D. T. & Co.....Duluth, Minn.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
La Salle & Co.....Duluth.
Mitchell & Co.....Cleveland.
Osborn & Co., F. H..... .....Chicago.
Pauly, H. J.....Milwaukee.
Parker & Millen.....Detroit.
Peck, Chas. E. & W. F.....New York and Chicago.
Richardson, W. C.....Cleveland.

IRON ORE AND PIG IRON.
Bourne-Fuller Co.....Cleveland.
Hanna, M. A. & Co.....Cleveland.
Pickands, Mather & Co.....Cleveland.

IRON OR STEEL STAYBOLTS, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

LATHES OF ALL KINDS.
American Tool Works Co. (The).....Cincinnati.
Niles Tool Works Co.....Hamilton, O.

LAUNCHES—NAPHTHA, ELECTRIC.
Electric Boat Co.....New York.
Gas Engine & Power Co.....New York.

LIFE PRESERVERS, LIFE BOATS, BUOYS, RAFTS, ETC.
Armstrong Cork Co.....Pittsburg.
Drein, Thos. & Son.....Wilmington, Del.
Kahnweiler's Sons, D.....New York.
Lane & DeGroot.....Brooklyn.

LIGHTS, SIDE AND SIGNAL.
Page Bros. & Co.....Boston.

LUBRICATING PUMPS.
Phenix Metallic Packing Co.....Chicago.
Sterling Lubricator Co.....Rochester, N. Y.

MACHINE TOOLS.
American Tool Works Co. (The).....Cincinnati.
Niles Tool Works Co.....Hamilton, O.
Pelton Engineering Co.....Cleveland.

MACHINE TOOLS (WOOD WORKING).
Fay & Egan Co., J. A.....Cincinnati, O.
Woods Machine Co., S. A.....So. Boston.

MATTRESSES, CUSHIONS, BEDDING.
Fogg, M. W.....New York.

METALLIC PACKING.
Katzenstein, L. & Co.....New York.
Phenix Metallic Packing Co.....Chicago.
U. S. Metallic Packing Co.....Philadelphia.

METALS FOR BEARINGS.
Cramp, Wm. & Sons.....Philadelphia.
Illinois Smelting & Refining Works.....Chicago.
Magnolia Metal Co.....New York.
Phosphor Bronze Smelting Co., Ltd...Philadelphia.

METAL POLISH.
Bertram's Oil Polish Co.....Boston, Mass.

MILLING MACHINES OF ALL KINDS.
American Tool Works Co. (The).....Cincinnati.
Niles Tool Works Co.....Hamilton, O.

NAUTICAL INSTRUMENTS.
Bliss, John & Co.....New York.
Ritchie & Sons, E. S.....Brookline, Mass.

NAVAL ARCHITECTS.
Curr, Robert.....Cleveland.
Hillman, Gustav.....Brooklyn.
See, Horace.....New York.
Wood, W. J.....Chicago.

NICKEL STEEL FORGINGS.
Bethlehem Steel Co.....So. Bethlehem, Pa.

OAKUM.
Stratford Oakum Co., Geo.....Jersey City, N. J.

OILS AND LUBRICANTS.
Dixon Crucible Co., Jos.....Jersey City, N. J.
Standard Oil Co.....Cleveland.

PACKING.
Jenkins Bros.....New York.
Katzenstein, L. & Co.....New York.
Phenix Metallic Packing Co.....Chicago.
U. S. Metallic Packing Co.....Philadelphia.

PAINTS.
Baker, Howard H. & Co.....Buffalo.
Smith, Edward & Co.....New York.
Upson-Walton Co.....Cleveland.

PAINTING MACHINES, PNEUMATIC.
Chicago Pneumatic Tool Co.....Chicago.

PATENT ATTORNEYS.
Thurston & Bates.....Cleveland.

PATTERN SHOP MACHINERY.
Fay & Egan Co., J. A.....Cincinnati, O.
Woods Machine Co., S. A..... .....So. Boston.

PIPE, WROUGHT IRON.
Bourne-Fuller Co.....Cleveland.

PLANERS OF ALL KINDS.
American Tool Works Co. (The).....Cincinnati.
Niles Tool Works Co.....Hamilton, O.

PLANING MILL MACHINERY.
Fay & Egan Co., J. A.....Cincinnati, O.
Woods Machine Co., S. A.....So. Boston.

PLUMBING, MARINE.
Ellis Marine Plumbing Co.....New York.
Mott Iron Works, J. L.....New York.
Sands, Alfred B. & Son.....New York.
Kenney, The Co.....New York.

PNEUMATIC TOOLS.
Chicago Pneumatic Tool Co.....Chicago.
Philadelphia Pneumatic Tool Co.....Philadelphia.
Standard Pneumatic Tool Co..... .....Chicago.

POLISH FOR METALS.
Bertram's Oil Polish Co.....Boston, Mass.

PROPELLER WHEELS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works Ltd.....Bath, Me.
Case, A. Wells & Son.....Highland Park, Conn.
Cramp, Wm. & Sons.....Philadelphia.
Detroit Shipbuilding Co.....Detroit.
Farrar & Trefts.....Buffalo.
Fore River Engine Co.....Weymouth, Mass
Hardy, John B..... .....Tacoma, Wash.
Hyde Windlass Co.....Bath Me.
Harlan & Hollingsworth Co.....Wilmington, Del.
Hodge, S. F. & Co.....Detroit.
Jenks Ship Building Co.....Port Huron, Mich.
MacKinnon Mfg Co.....Bay City, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Morse Iron Works & Dry Dock Co.....Brooklyn.
Neafie & Levy Ship & Eng. Bldg Co...Philadelphia.
Newport News Ship Bldg. Co..Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Phosphor Bronze Smelting Co., Ltd...Philadelphia.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Sheriffs Mnfg. Co.....Milwaukee.
Trigg, Wm. R. Co.....Richmond, Va.
Trout, H. G.....Buffalo.
Union Iron Works.....San Francisco.
Wolff & Zwicker Iron Works.....Portland, Ore.

PROJECTORS, ELECTRIC.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Sprague Electric Co..... .....New York.
Westinghouse Electric & Mnfg. Co...Pittsburg, Pa.

PUMPS FOR VARIOUS PURPOSES.
Blake, Geo. F. Mnfg. Co.....New York.
Davidson, M. T.....Brooklyn, N. Y.
Donohue & Co., John T.....Baltimore.
Kingsford Foundry & Machine Works..... .....Oswego, N. Y.
Van Duzen, The E. W. Co.....Cincinnati.
Worthington, Henry R.....New York.

PUNCHES, RIVETERS, SHEARS.
American Tool Works Co. (The).....Cincinnati.
Cleveland Punch & Shear Works Co.. ...Cleveland.
New Doty Mnfg. Co.....Janesville, Wis.
Niles Tool Works Co.....Hamilton, O.
Wood & Co., R. D.....Philadelphia.

REGISTER FOR CLASSIFICATION OF VESSELS.
Great Lakes Register.....Cleveland.

RELEASING HOOKS FOR DETACHING BOATS.
Standard Aut. Releasing Hook Co.....New York.

RIVETS, STEEL, FOR SHIPS AND BOILERS.
Bourne-Fuller Co.....Cleveland.
Champion Rivet Co.....Cleveland.

RIGGING ROPE (WIRE).
American Steel & Wire Co.....Chicago.

RUBBER INSULATED WIRES.
Roebling's Sons, John A..New York and Cleveland.
American Steel & Wire Co.....Chicago.

SAFETY VALVES.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.

SAIL MAKERS.
Baker, Howard H. & Co.....Buffalo.
Upson-Walton Co.....Cleveland.
Wilson & Silsby.....Boston.

SALVAGE COMPANIES.
See wrecking companies.

SCHOOLS, CORRESPONDENCE—ENGINEERING AND NAVIGATION.
International Correspondence Schools.....Scranton, Pa.

SCREW MACHINES.
American Tool Works Co. (The).....Cincinnati.
Niles Tool Works Co.....Hamilton, O.

SEARCH LIGHTS.
Elwell-Parker Electric Co.....Cleveland.
General Electric Co.....Schenectady, N. Y.
Rushmore Dynamo Works.....Jersey City, N. J.
Sprague Electric Co.....New York.
Westinghouse Electric & Mnfg. Co...Pittsburg, Pa.

SEPARATORS, (CENTRIFUGAL).
Keystone Engine & Machine Works, W. L. Simpson, Engineer.....Philadelphia.

SHAPERS.
American Tool Works Co. (The).....Cincinnati.
Niles Tool Works Co.....Hamilton, O.

SHEARS.
See punches, riveters and shears.

SHIP AND BOILER PLATES AND SHAPES.
Bourne-Fuller Co.....Cleveland.

SHIP BUILDERS.
American Ship Building Co.....Cleveland.
Atlantic Works.....East Boston, Mass.
Bath Iron Works, Ltd.....Bath, Me.
Buffalo Dry Dock Co.....Buffalo.
Cramp, Wm. & Sons.....Philadelphia.
Craig Ship Building Co.....Toledo, O.
Chicago Ship Building Co.....Chicago.
Detroit Shipbuilding Co.....Detroit.
Fore River Engine Co.....Weymouth, Mass.
Hardy, John B.....Tacoma, Wash.
Harlan & Hollingsworth Co.....Wilmington, Del.
Iowa Iron Works.....Dubuque, Ia.
Jenks Ship Building Co.....Port Huron, Mich.
Maryland Steel Co.....Sparrow's Point, Md.
Moran Bros. Co.....Seattle, Wash.
Morse Iron Works & Dry Dock Co.....Brooklyn.
Neafie & Levy Ship & Eng. Bldg. Co..Philadelphia.
Newport News Ship Bldg. Co...Newport News, Va.
Nixon, Lewis.....Elizabeth, N. J.
Pusey & Jones Co.....Wilmington, Del.
Risdon Iron Works.....San Francisco.
Roach's Ship Yard.....Chester, Pa.
Townsend & Downey Ship Bldg. Co.....New York.
Trigg, Wm. R. Co.....Richmond, Va.
Union Dry Dock Co.....Buffalo.
Union Iron Works.....San Francisco.
Wolff & Zwicker Iron Works.....Portland, Ore.

SHIP CHANDLERS.
Baker, Howard H. & Co.....Buffalo.
Marine Supply Co..... .....Fairport Harbor, O.
Moran, Bros. Co.....Seattle, Wash.
Upson-Walton Co.....Cleveland.

SPARS—LARGE SIZES.
Moran Bros. Co.....Seattle, Wash.

STAYBOLTS, IRON OR STEEL, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

STEAM VESSEL FOR SALE.
Holmes, Samuel.....New York.

STEEL OR IRON STAYBOLTS, HOLLOW OR SOLID.
Falls Hollow Staybolt Co.....Cuyahoga Falls, O.

BUYERS' DIRECTORY OF THE MARINE TRADE.—Continued.

STEAMSHIP LINES, PASS. AND FREIGHT.
American Line.....New York.
Erie & Western Trans. Co.....Buffalo.
International Nav. Co.....Philadelphia.
Red Star Line.....New York.

STEEL SHAFTS, SOLID OR HOLLOW.
Bethlehem Steel Co.....So. Bethlehem, Pa.

STEERING APPARATUS.
American Ship Building Co.....Cleveland.
Chase Machine Co.....Cleveland.
Detroit Shipbuilding Co.....Detroit.
Donohue & Co., John T.....Baltimore.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.
Queen City Engineering Co.....Buffalo.
Sheriffs Mfg. Co.....Milwaukee.

STOCKS, BONDS, SECURITIES.
Wright, Herbert & Co.....Cleveland.

STOCKLESS ANCHORS.
Baldt Anchor Co.....Chester, Pa.
International Anchor Co.....Cleveland.

STRUCTURES OF STEEL, BUILDERS OF.
American Bridge Co.....New York.

SURVEYORS, MARINE.
Curr, Robert.....Cleveland.
Gibbs & Joys.....Milwaukee.

TELEGRAPH—DECK AND ENGINE ROOM.
Cory, Chas. & Son.....New York.

TESTS OF MATERIAL.
Hunt, Robert W. & Co.....Chicago.
Pittsburgh Testing Laboratory, Ltd.....Pittsburgh.

THRUST COLLARS FOR PROPELLER SHAFTS.
Ball Bearing Co.....Boston, Mass.

TIMBER—LARGE PIECES.
Moran Bros. Co.....Seattle, Wash.

TOOLS, METAL WORKING, FOR SHIP AND ENGINE WORKS.
American Tool Works Co. (The).....Cincinnati.
Chicago Pneumatic Tool Co.....Chicago.
Cleveland Punch & Shear Works Co. ...Cleveland.
New Doty Mnfg. Co.....Janesville, Wis.
Niles Tool Works Co.....Hamilton, O.
Pelton Engineering Co.....Cleveland.
Philadelphia Pneumatic Tool Co.....Philadelphia.
Standard Pneumatic Tool Co.....Chicago.
Wood & Co., R. D.....Philadelphia.

TOOLS, WOOD WORKING.
Fay & Egan Co., J. A.....Cincinnati, O.
Woods Machine Co., S. A.....So. Boston.

TRUCKS.
Boston & Lockport Block Co.....Boston, Mass.

TOWING MACHINES.
American Ship Windlass Co.....Providence, R. I.
Chase Machine Co.....Cleveland.
Playfair's Barge & Tug Line.....Midland, Ont.

TOWING COMPANIES.
Calvin Co., The.....Kingston, Ont.
Donnelly Salvage & Wrecking Co...Kingston, Ont.
Swain Wrecking Co.....Detroit.

TUBING FOR BOILERS.
Atlantic Tube Co.....Pittsburg.
Shelby Steel Tube Co.....Cleveland.

TUBES, SEAMLESS DRAWN, BRASS AND COPPER.
Hungerford Brass & Copper Co., U. T.....New York.

VALVES, STEAM SPECIALTIES, ETC.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.
Jenkins Bros.....New York.

VARNISH MAKERS, COLOR GRINDERS, ETC.
Smith, Edward & Co.....New York.

VARNISH PAINT.
Mair, John & Son.....Philadelphia.

VESSEL AND FREIGHT AGENTS.
Boland, John J.....Buffalo.
Brown & Co.....Buffalo.
Bull & Co, A. H.....New York.
Drake & Maytham.....Buffalo.
Elphicke, C. W. & Co.....Chicago.
Gibbs & Joys.....Milwaukee.
Hall & Root.....Buffalo.
Hawgood & Moore.....Cleveland.
Helm, D. T. & Co.....Duluth, Minn.
Holmes, Samuel.....New York.
Hutchinson & Co.....Cleveland.
Keith, J. G. & Co.....Chicago.
Mitchell & Co.....Cleveland.
Moffat & O'Brien.....San Francisco.
Pauly, H. J.....Milwaukee.
Richardson, W. C.....Cleveland.

VENTILATING APPARATUS FOR SHIPS.
Buffalo Forge Co.....Buffalo.
Sprague Electric Co.....New York.
Sturtevant Co., B. F.....Boston.

WIRE ROPE AND WIRE ROPE FITTINGS.
American Steel & Wire Co.....Chicago.
Baker, H. H. & Co.....Buffalo.
Roebling's Sons, John A..New York and Cleveland.
Upson-Walton Co.....Cleveland.

WHISTLES, STEAM.
American Steam Gauge Co.....Boston.
Ashton Valve Co.....Boston.
Crosby Steam Gage & Valve Co.....Boston.
Signal & Control Co.....New York.

WINDLASSES.
American Ship Windlass Co.....Providence, R. I.
American Ship Building Co.....Cleveland.
Hyde Windlass Co.....Bath, Me.
Jenks Ship Building Co.....Port Huron, Mich.

WINCHES.
American Ship Windlass Co.....Providence, R. I.
Hyde Windlass Co.....Bath, Me.

WOOD WORKING MACHINERY.
Fay & Egan Co., J. A.....Cincinnati, O.
Woods Machine Co., S. A.....So. Boston.

WORM GEARING.
Morse, Williams & Co.....Philadelphia.

WRECKING AND SALVAGE COMPANIES.
Calvin Co., The.....Kingston, Ont.
Donnelly Salvage & Wrecking Co...Kingston, Ont.
Playfair's Barge & Tug Line.....Midland, Ont.
Swain Wrecking Co.....Detroit.

YACHT SAILS, FITTINGS, HARDWARE, ETC.
Wilson & Silsby.....Boston.

YACHT AND BOAT BUILDERS.
Drein, Thos. & Son.....Wilmington, Del.
Electric Boat Co.....New York.
Gas Engine & Power Co.....New York.
Lane & DeGroot.....Brooklyn.

YACHT, MARINE AND SHIPS' BELL CLOCKS.
Ashton Valve Co.....Boston.
Bliss, John & Co.....New York.
Ritchie, E. S. & Sons.....Brookline, Mass.

YAWLS.
Drein, Thos. & Son.....Wilmington, Del.
Lane & DeGroot.....Brooklyn.

ALPHABETICAL INDEX OF ADVERTISERS IN THE MARINE REVIEW.

The star (*) indicates that the advertisement appears alternate weeks. For addresses see advertisements on pages noted.

WANTED, FOR SALE, FOR CHARTER, Etc.

Space under this heading 25 cents a line, each insertion, for three insertions or less. Special rates for periods of more than three insertions.

—FOR SALE—Side-wheel steamer John F. Lincoln, with all equipment, including electric light plant. May be inspected at Cape Girardeau, Mo. For sale, also, very cheap, horizontal boiler 24 feet by 47 inches, with ten 6-inch tubes, and allowed 160 pounds of steam; $150 will buy a complete set of tug machinery—engine 12 1-16x18, with 4-inch shaft, stuffing box, journal bearings, and a 4½-foot wheel. Address Linehan Railway Transfer Co., Dubuque, Ia. July 26

WANTED—First-class steambarge, 1,000 tons or more capacity, suitable for coarse and package freight. State lowest cash price. F. W. Putman, 720 Old Colony Bldg., Chicago, Ill. July 19

—FOR SALE—Second-hand tug of 7.47 tons. Compound engine. Complete for business. Will be sold at a bargain. Address ENG, Marine Review, Office Marine Review Pub. Co., Cleveland, O. d

—WANTED—Naphtha launch suitable for delivering goods in harbor. Tonnage about 5 or 6 gross. Will pay cash for new boat or for second-hand if in good order. Ship Chandler, Marine Review Pub. Co., Cleveland, O. d

—FOR SALE—Marine boiler of 6½ by 12 feet. Allowed 110 pounds steam. Never been cut. Also breeching smokestack and grates. E. E. Koch, Sandusky, O. Sept. 21.

—FOR SALE—Scotch marine water-back boiler; 7 feet diameter, 11 feet long; dome 30x30 inches; furnace 40 inches diameter; 69 3-inch tubes, 8 feet 6 inches long. Built under government inspection and just completed. Price $2,000. F. O. B. cars Minneapolis. Address Nicollect Island Boiler Works, Minneapolis, Minn. tf

MARINE REVIEW

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